

NSW Planning ref: DA85/2865-PA-61
Mrs Alycia O'Brien
Environmental Compliance Manager
Benedict Recycling Pty Limited
11 Narabang Way
BELROSE, NSW 2085
23/04/2025

Sent via the Major Projects Portal only

Subject: Menangle Quarry - Annual Review 2024

Dear Mrs O'Brien

I refer to the Annual Review for the reporting period from 1 January 2024 to 31 December 2024 for Menangle Quarry ("the development"), submitted for the Planning Secretary's consideration, as required under Schedule 2, Conditions D9 of the development consent DA 85/2865, as modified ("the consent").

The NSW Department of Planning, Housing and Infrastructure (NSW Planning) considers that the Annual Review, generally satisfied Condition D9 of the consent.

Please note that approval of this Annual Review is not endorsement of the compliance status of the development.

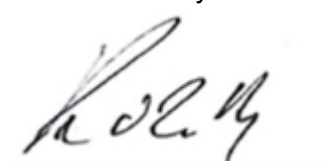
I note no non-compliances were reported during the reporting period.

Please review, and if necessary, revise, the strategies, plans, and programs required under the consent and submit for Planning Secretary's approval, in accordance with Schedule 2, Condition D5 of the consent.

Lastly, in accordance with Schedule 2, Condition D15 of the consent, please make the copy of the Annual Review available on the company website, including any other documents required under Condition D15, and also ensure that these documents are up-to-date.

Should you need to discuss the above, please contact Georgia Dragicevic, Senior Compliance Officer, on (02) 4247 1852 or by email to Georgia.Dragicevic@planning.nsw.gov.au.

Yours sincerely



Katrina O'Reilly
Team Leader - Compliance
Compliance

As nominee of the Planning Secretary

MENANGLE SAND AND SOIL ANNUAL REVIEW (Condition D9)



Benedict Sands Menangle (LEC 2018/342158)

01 January 2024 - 31 December 2024

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1 Introduction

1.1 Overview & Follow up

Benedict Industries Pty Ltd (Benedict) is the operator of the Menangle Soil and Sand Facility (MSS) located at 31 Menangle Road, Menangle NSW 2568.

Condition D9 of the Consolidated Consent approval requires the preparation of an annual review of the environmental performance of the Development.

This is the second annual review and is for the period 01 January 2024 – 31 December 2024.

Acknowledgement that the 2023-year submission was satisfactory, and any recommendations below have been incorporated into this 2024 Review document.

Department of Planning, Housing and Infrastructure



NSW Planning ref: DA85/2865-PA-38
Mr Ewen McKenzie
Acting Environmental Compliance Manager
BENEDICT RECYCLING PTY LIMITED
11 NARABANG WAY
BELROSE New South Wales 2085
02/08/2024

Sent via the Major Projects Portal only

Subject: Menangle Quarry - 2023 Annual Review

Dear Mr McKenzie

Reference is made to your post approval matter, DA85/2865-PA-38, Annual Review for the period 1 January 2023 to 31 December 2023 for Menangle Quarry, submitted as required by Schedule D, Condition 9 of DA85/2865 (the consent) to the NSW Department of Planning, Housing and Infrastructure (NSW Planning) on 22 April 2024.

NSW Planning has reviewed the Annual Review and considers it to generally satisfy the reporting requirements of the consent and the NSW Planning Annual Review Guideline (October 2015). Please make publicly available a copy of the 2023 Annual Review on the company's website within 30 days.

Please also upload to the website the monitoring associated with all management plans (that is, a comprehensive summary of the monitoring results of the development, reported in accordance with the specifications in any conditions of this consent, or any approved plans and programs) in accordance with Condition D15(iv), Rehabilitation monitoring and a complaints number in accordance with D15(vii) (contact details to enquire about the development or to make a complaint) within 30 days from the date of this letter.

Please ensure that the website is kept up-to-date with all required information and documents.

For future Annual Reviews please include the following information:

- maps of the operation showing the regional context (aspects relevant to the community such as residential areas or other key relevant land uses), development consent boundary, current operational disturbance footprint, and any offset areas and approved limits of extraction; and
- a summary of criteria, performance, trends/ key management implications and proposed management actions (similar to Table 6 in the Mining Annual Review Guidelines).

Please note that the NSW Planning's acceptance of this Annual Review is not an endorsement of the compliance status of the project.

In accordance with the conditions of consent please ensure that strategies, management plans and programs are reviewed and if necessary revised and submitted to the Planning Secretary's for approval.

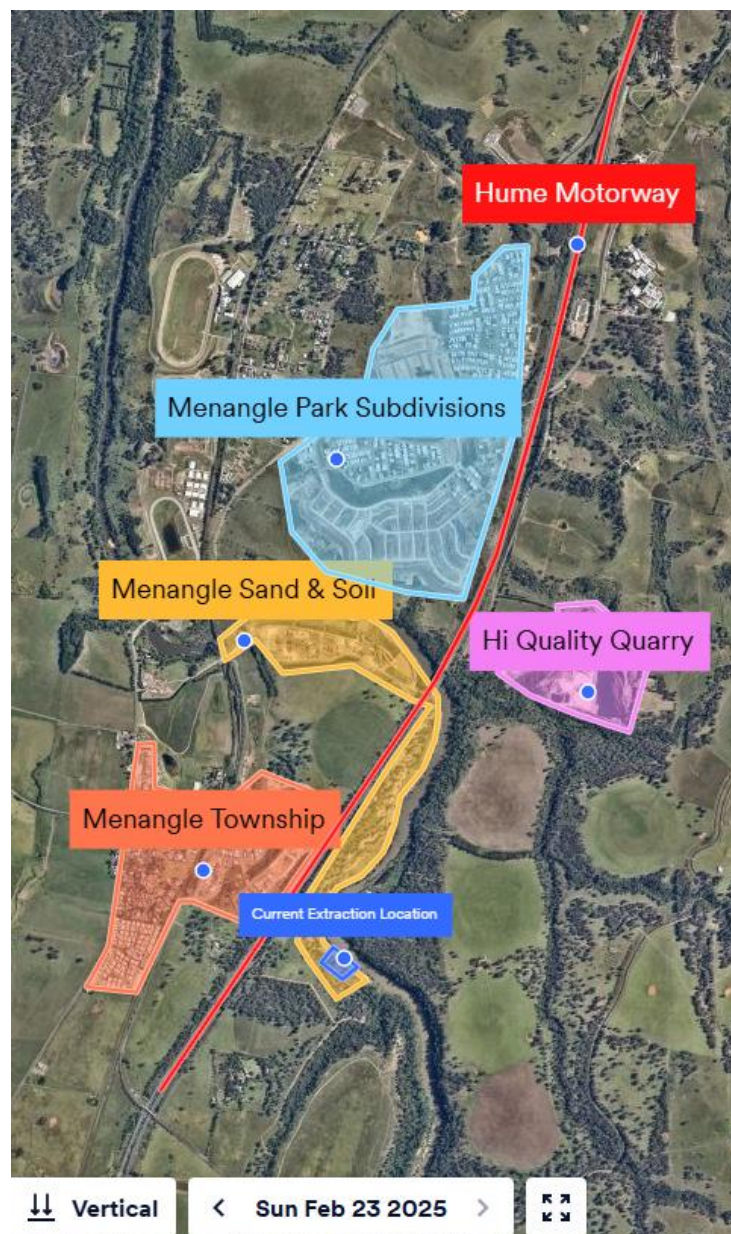
Should you wish to discuss the matter further, please contact me on 0429400261 or email compliance@planning.nsw.gov.au

Yours sincerely

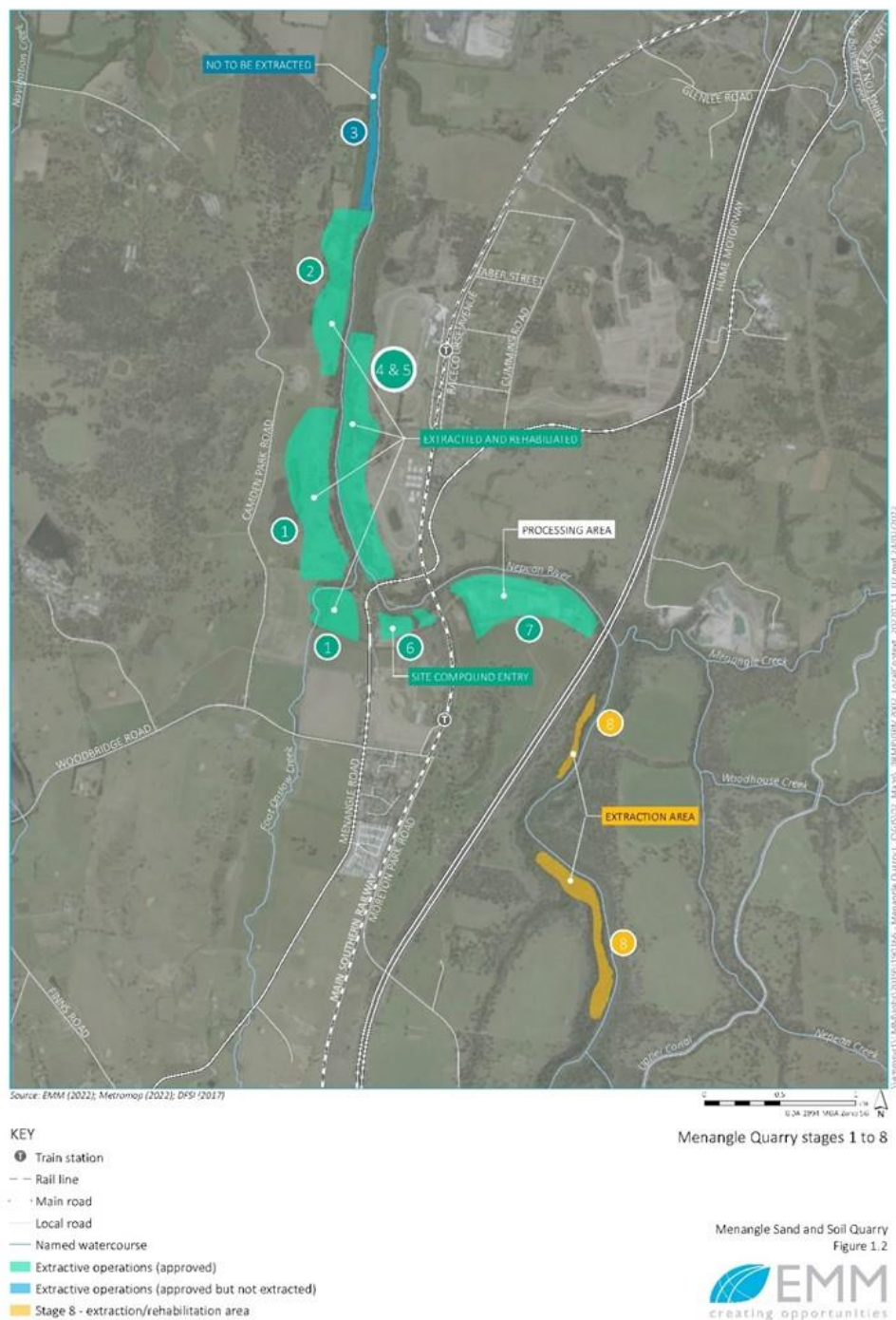


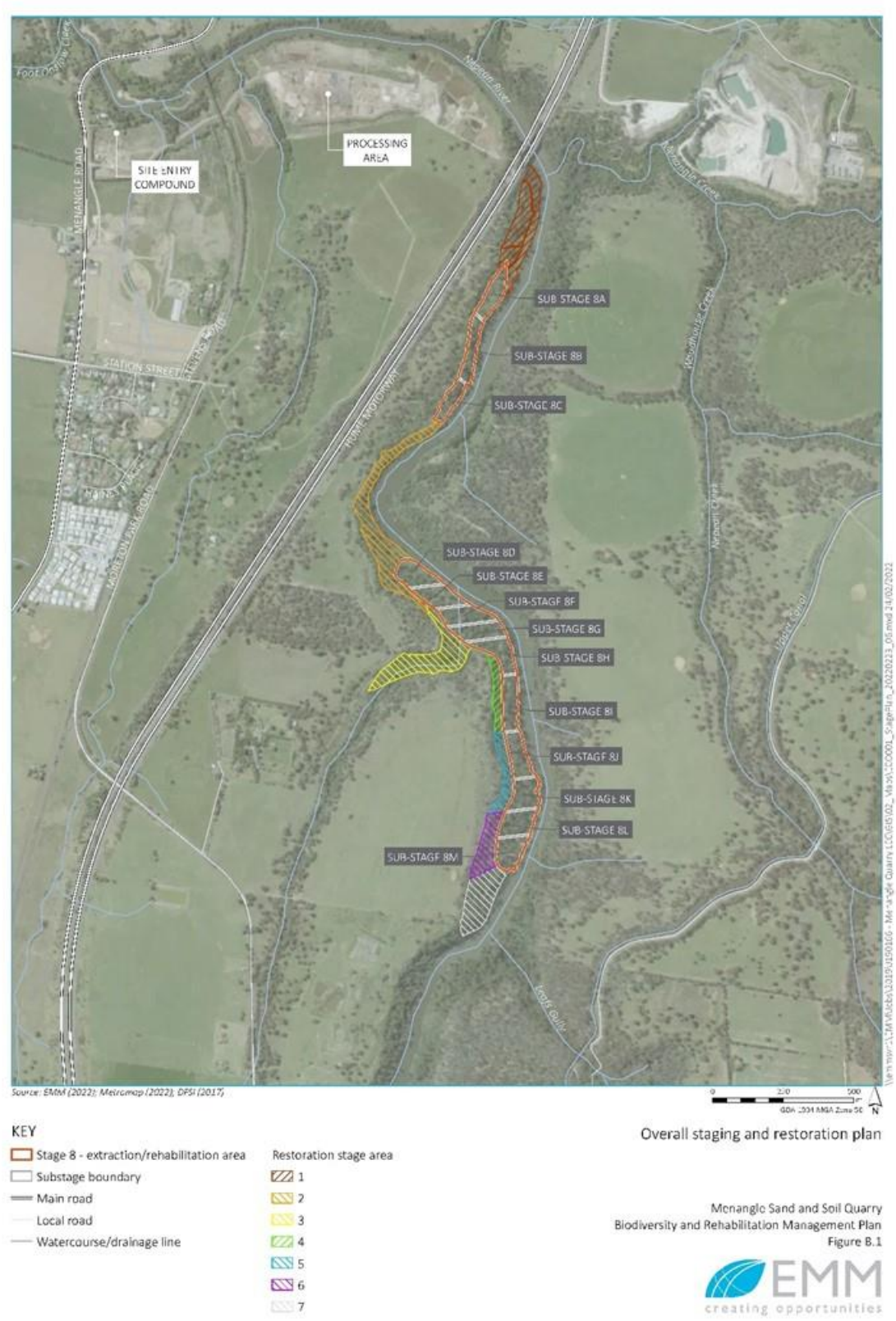
Katrina O'Reilly
Team Leader - Compliance
Compliance
As nominee of the Planning Secretary

Regional Location Context and Quarry activity



Specific staging maps for the entire MSS facility are shown below as well as the Staging Areas for Stage 8 which is the current quarrying activity area. The quarrying activity during 2024 was predominantly in Stages 8B and 8C, whilst rehabilitation activity has occurred across Stages 8A through Stages 8C notable during two flooding events which wiped out previous 2023 Stage 8 rehabilitation works, in mid-2024





2 Development

Describe the development (including any rehabilitation) that was carried out in the previous calendar year, and the development that is proposed to be carried out over the current calendar year?

2024 development included:

- Commencement of quarrying in Substage 8C & 8D
- New Rehabilitation work in Substage 8B and 8C
- Repeated Rehabilitation work in Stages 6 & 7, Substages 8A & 8B due to two significant flooding events

3 Monitoring Results and Complaints

Include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, including a comparison of these results against the:

- *relevant statutory requirements, limits or performance measures/criteria*

NOISE MONITORING

Noise (Condition B4)

B4. The Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 2 at any Residence on privately-owned land.

Table 2: Operational Noise Criteria dB(A) Residences a		Day	Shoulder Period 6.00 am to 7.00 am Monday to Saturday LA(max)
<i>LAeq (15 minute)</i>		<i>LAeq (15 minute)</i>	
2, 3, 5b, 6, 7, 8, 9	45	45	55
4	54	52	62
10, 11	35	35	45
All other Residences	35	35	45

An example of the Noise monitoring reporting is included as Attachment B. Quarterly testing has been occurring. In 2024 Noise testing occurred in March, May, August and November. In all of the four reports conducted by EMM the noise results was:

“Noise levels from site complied with all relevant limits and consent noise conditions.”

AIR QUALITY MONITORING

Condition B14 requires the preparation of an Air Quality Management Plan which was version 9, produced by EMM and approved by the DPE on 19 April 2022.

Condition D5 of the Consent requires review of the Management Plans within 3 months of the completion of the Annual Review. After the submission of the 2023 Annual Review, it was proposed to update the Air Quality Monitoring program by moving one of the dust gauges (DDG01) some 130m to the West to avoid sample contamination by regular mowing activities.

Secondly, as the two, four-week ambient air quality monitoring campaigns have been successfully completed it was also proposed to remove these requirements from the AQMP.

These changes to the AQMP were accepted by NSW Planning on 13/09/2024 (see [chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.benedict.com.au/wp-content/uploads/AQMP-final.pdf](https://www.benedict.com.au/wp-content/uploads/AQMP-final.pdf))

Within the AQMP there is now one monitoring activities required:

1. Regular air quality monitoring

Permanent dust monitors are located on site at three locations. Since quarry operations commenced on Stage 8, the results of the dust monitoring have been posted online (see: [chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.benedict.com.au/wp-content/uploads/Menangle-Dust-Monitoring-Results-2024-8.pdf](https://www.benedict.com.au/wp-content/uploads/Menangle-Dust-Monitoring-Results-2024-8.pdf))

Summary dust monitor results from January 2024 – December 2024 are listed below.

Month	Particulate	Unit	Lowest value	Highest value	Mean of samples
January	Ash Content	g/m2	0.3	2.8	1.6
	Combustible matter	g/m2	0.2	2.4	1.4
February	Ash Content	g/m2	0.3	1.8	1.1
	Combustible matter	g/m2	0.3	1.6	0.8
March	Ash Content	g/m2	0.1	1.3	0.6
	Combustible matter	g/m2	0.1	1.1	0.5
April	Ash Content	g/m2	0.6	0.8	0.7
	Combustible matter	g/m2	0.4	0.7	0.6
May	Ash Content	g/m2	0.1	1.3	0.5
	Combustible matter	g/m2	0.1	1.0	0.4
June	Ash Content	g/m2	0.1	0.4	0.2

	Combustible matter	g/m2	0.1	0.3	0.2
July	Ash Content	g/m2	0.1	1.2	0.7
	Combustible matter	g/m2	0.2	1.0	0.6
August	Ash Content	g/m2	0.3	1.3	0.7
	Combustible matter	g/m2	0.3	1.0	0.6
September	Ash Content	g/m2	0.3	14.6	5.2
	Combustible matter	g/m2	0.2	8.0	2.9
October	Ash Content	g/m2	0.6	2.3	1.2
	Combustible matter	g/m2	0.5	1.9	1.1
November	Ash Content	g/m2	1.0	6.2	2.8
	Combustible matter	g/m2	0.7	4.8	2.1
December	Ash Content	g/m2	0.4	2.7	1.9
	Combustible matter	g/m2	0.3	2.1	1.4

The mean dust monitoring results are generally compliant. The only monitoring anomaly is in the November/December where at DDG1 (site entry compound) the results are impacted by seasonal mowing in preparation for bushfire season. This was also identified by EMM in the Ambient air quality monitoring. It is worth noting that this DDG1 location is also impacted by the nearby Menangle Road and significant land subdivision release earthworks to the North and South of the location.

GROUNDWATER MONITORING

Condition B19 requires annual groundwater monitoring to be conducted at 5 locations. This was conducted quarterly in terms of data capture and EMM has produced a summary report in March 2025 (see Attachment C), the Conclusion from the report reads as below :

“Recommendations

EMM provides the following recommendations:

- Automated pressure transducers are maintained within the groundwater monitoring network, and replaced where required.
- Groundwater quality trigger values for pH are reviewed in the SWMP, ensuring all baseline data (prior to the commencement of quarrying) is considered.
- Groundwater quality sampling is undertaken for the 2025 calendar year.

Conclusion

A groundwater data review was undertaken for the 2024 calendar year. Groundwater level exceedances and groundwater quality exceedances (for electrical conductivity) were not recorded, in accordance with the SWMP. Minimum groundwater quality trigger values (for pH) were exceeded at five bores in the monitoring network; however the exceedances are not considered a result of quarrying activities.” (P9/10 Groundwater Data Review for 2024)

COMPLAINTS (EPA Licence)

Site complaints have been monitored since January 2021 and the results are posted on our website each month.

In the 2024 period there we no site complaints received (see: chrome-extension://efaidnbmninnibpcajpcglclefindmkaj/https://www.benedict.com.au/wp-content/uploads/Menangle-Site-Complaints-2024-7.pdf)

CONSENT CONDITIONS COMPLIANCE – compliance or triggered analysis for full Consent – see Attachment A

- requirements of any plan or program required under this consent.

The requirements and triggers are addressed through the Consent Condition compliance comments and triggers. Other key plan actions are listed below:

Annual Production data supplied to MEG	Supplied 2024 (March 2025)
Annual engineering assessment of Hume Highway Underpass	This was complete by Bridge Designs Pty Ltd on 10 December 2024 and submitted to TfNSW on the 16 th December 2024
Site Rehabilitation and Restoration Annual Progress Report	Supplied - see Attachment D and additional Prog Report Attachments due to file sizes
Includes:	
Landform establishment and stability assessment	
Growth medium development assessment	
Floristic Monitoring assessment	

Weed monitoring assessment.
 Nest-Box and Woody debris assessment
 UASS: Revised Rehabilitation Methodology Oct 2024

Review of BRMP Summary Monitoring Report	Supplied - see Attachment E
Independent Environmental Audit	Due March 2025 - Supplied by separate lodgement
Annual water balance review	Due April 2025
Surface Water Monitoring Program	Commenced March 2024 and will be collected monthly for 12 months and then default to quarterly monitoring.

- **monitoring results of previous years**

The required EPL Complaints Monitoring for the site prior to 2023 has been carried out monthly since 2001. There have been no complaints

- **relevant predictions in the documents listed condition A7(c) [MOD 1 Summary, Layout, Report]**

The commencement of quarrying in Stage 8 occurred on 4 September 2023. The development has been occurring generally in accordance with all the respective development Conditions of Consent and Management Plans. Rehabilitation and monitoring results have been impeded by two significant flood events

A rolling schedule of all the Compliance actions for 2024 has been developed in line with the Stage 8 start date and this has been attached as Attachment F

4 Non-compliances or incidents

Identify any non-compliance or incident which occurred in the previous calendar year, and describe what actions were (or are being) taken to rectify the non-compliance and avoid reoccurrence.

Two Flood events occurred during 2024. One occurred in May and the second in June. These both had significant impacts on the quarry function and impeded the physical rehabilitation efforts across Stages 6,7 & 8 and required significant clean-up activities. As a result of the increasing frequency and severity of the flooding alternate planting methodologies have been investigated and implemented in the last quarter of 2024. Detail of the amended strategy are included in the Rehabilitation Progress Report in Attachment D

Flood Event – April 6 2024

The responsibilities contained in Table 5.2 Flood scour and risk remedial response TARP, of the Flood Management Plan were followed as below:

Prior to flooding

- Quarry personnel advised
- BOM monitoring – hourly
- Substages 8C prepared (backfill and batter to 1:5 adjacent to river)
- Flatten exposed extraction batters and smooth all sand and soil

All Plant and equipment moved to higher ground

Affected Areas of Quarry

Stage 6

Stage 7

Restoration Area 1

Substage 8A (rehabilitation)

Substage 8B (rehabilitation)

Substage 8C (extraction)

Post flood



Incident Report created – see Attachment G

Clean up debris

Clean out silt deposits on rehabilitated land and fill any eroded landform

Inspect affected tree health and stability (none affected)

Reinstate monitoring plot boundaries

Retrieve and relocate available woody debris

Assess impact on seeding and planting (order plants)

Reinstate scoured batters to maximum batter angles

Ensure the extraction base level has not been scoured and reestablished the extraction level 1m above the extraction groundwater level

Flood Event - June 6 2024



The responsibilities contained in Table 5.2 Flood scour and risk remedial response TARP, of the Flood Management Plan were followed as below bearing in mind that the recovery from the April flood had not been completed:

Prior to flooding

- Quarry personnel advised
- BOM monitoring – hourly
- Substage 8C prepared (backfill and batter to 1:5 adjacent to river)
- Flatten exposed extraction batters and smooth all sand and soil
- All Plant and equipment moved to higher ground

Affected Areas of Quarry

Stage 6

Stage 7
Restoration Area 1
Substage 8A (rehabilitation)
Substage 8B (rehabilitation)
Substage 8C (extraction)

Post flood

Incident Report created – see Attachment H
Clean up debris
Clean out additional silt deposits on rehabilitated land and fill any eroded landform
Inspect affected tree health and stability (none affected)
Reinstate monitoring plot boundaries
Retrieve and relocate available woody debris
Assess impact on seeding and planting (order plants)
Reinstate scoured batters to maximum batter angles
Ensure the extraction base level has not been scoured and reestablished the extraction level 1m above the extraction groundwater level

Sediment deposits



Rehabilitation Recovery

Rehabilitation planting strategy was reviewed as the ability to rehabilitate the landform was proving unsustainable.

An expert in Urban Agronomy and Soil Science (UASS) was engaged to review the rehabilitation methodology and science as the Biodiversity and Rehabilitation Management Plan (BRMP) and to some extent the Flood Management Plan (FMP) were developed on a methodology that did not predict the rapid frequency of flood events. What effectively was a 1 in ten-year event in the 1970-1990 era has now turned into 6 flood events in the last five years (2020, 2021, 2022 x 2, 2024 x 2). A report was produced by UASS in October titled *Menangle Sand and Soil Stage 8 Extraction Area Changes to the Rehabilitation Methodology October 2024* from which modified planting strategies have been adopted. The report has been included in BRMP Rehabilitation and Restoration Annual Progress Report 2024. See Attachment D

Pollution Incident Response Management Plan

The site, as required by the EPA, operates a Pollution Incident Response Management Plan (PIRMP)

The PIRMP documents are held on site and involve scenario toolbox training for staff. These are reviewed annually as part of the EPA Annual Report Process.

During 2024 the following preventative staff training was implemented:

- Warden / Chief Warden Training
- Building Evacuation Training
- Live Fire Training - Use of Portable Fire Fighting Equipment
- Silica Dust Awareness Training
- Isolation, Lockout and Safety Tagging Training
- Risk Assessment training

Mining Regulator Audits are conducted as follows:

- Air Quality or Dust and Other Airborne Contaminants
- Electrical
- Pressure Vessels
- Mobile Plant
- Legislation Gap Analysis (Mining Regs)
- Psychosocial Hazards

Significant Incidents 2024

- Flood events as above
- Contractor truck trailer rolled over whilst attempting to tip off material.

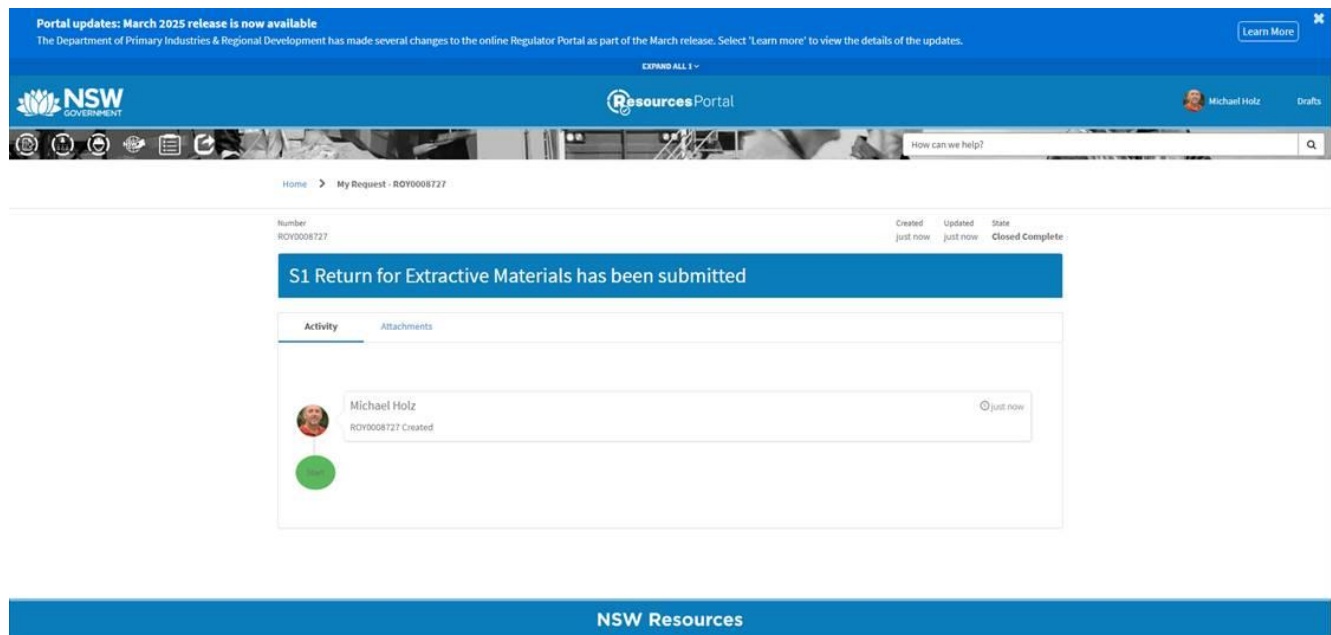
5 Compliance status summary

- ***Each year, from the date of commencement of Quarrying Operations in the Stage 8 Area, the Applicant must provide calendar year quarry production data to MEG by no later than 30 January. The data must be provided using the relevant standard form and a copy of the data must be included in the Annual Review. [Condition A37]***

A photographic record of the MEG lodgement for 2024 is included below:

The Stage 8 Tonnes lodged with the NSW Resource Regulator for 2024 was: 138,664 Tonnes.

The commercial value of the tonnes extracted was: \$5,073,989.99.



- ***The Applicant must report on any water captured, intercepted or extracted from the site each year (directly and indirectly) in the Annual Review, including water taken under each Water Access Licence as applicable. [Condition B30]***

Water is extracted by water pump from the Nepean River for dust suppression purposes. This activity is recorded and interfaced with WaterNSW. A copy of the 2024 records are attached as Attachment I

- ***The Applicant must ensure that the flood storage capacity of the final rehabilitated landform is no less than the pre-existing flood storage capacity at all stages of the development, unless otherwise approved in writing by the Planning Secretary. Details of the available flood storage capacity must be reported in the Annual Review. [Condition B35]***

The Stage 8 quarry is in its early stages and now has rehabilitated landforms (flood x 2 affected) applicable for this review is the final landforms in Substages 8A, 8B and 8C. We can confirm that the difference between the commencement levels and the final landform levels was a mean final landform reduction across the three stages of 3.31m which confirms that the flood storage capacity has not been compromised. Full details of levels across the three Substages are listed in Attachment A (see Condition B35).

- ***the effectiveness of the noise and air quality management systems and any other plans***

These management plans were reviewed by EMM and amendments were proposed. A summary of all the recommended Plan changes is below including those affecting noise and air quality. These will be reviewed within 3 months of this Annual Review and feedback given in the 2024 Annual Review.

Review of EMS and plans

EMM Consulting Pty Limited (EMM) has reviewed the environmental management system and associated plans. Recommended actions arising from the review are provided below.

Document	Approved version	Recommended actions ¹
Environmental Management Strategy	V3, 25/2/22	The EMS generally remains current but it is recommended that it is updated to reflect changes to management plans (as described below).
Noise Management Plan (NMP)	V7, 25/2/22	The NMP generally remains current but it is recommended that the monitoring programme is updated to reflect that the results of the two quarterly attended noise monitoring events reported in the 2023 Annual Review that found that site operations were inaudible at all monitoring locations on all occasions.
Air Quality Management Plan (AQMP)	V9, 31/3/22	The AQMP generally remains current but it is recommended that the monitoring programme is updated to reflect that: <ol style="list-style-type: none"> DDG01 is moved to prevent further sample contamination reported in the 2023 Annual Review. The two ambient air quality monitoring campaigns have been completed.
Flood Management Plan	V3, 25/2/22	The FMP remains current. No updates are recommended.
Soil and Water Management Plan (SWMP), including: Surface Water Management Plan Groundwater Management Plan	V3, 25/2/22	The SWMP generally remains current but it is recommended that the plan is updated as follows: <ol style="list-style-type: none"> The plan be extended to cover the remainder of the Stage 8 area. The Ephemeral Creek Management Plan be appended to the SWMP. Changes to the Stage 7 water management system are included.
Ephemeral Creek Management Plan	-	See above.
Traffic Management Plan (TMP)	V7, 25/2/22	The TMP generally remains current but it is recommended that the plan is updated to include reference the completed works under the Hume Motorway bridge in accordance with WAD SYD17/00793/04.
Aboriginal Cultural Heritage Management Plan (ACHMP)	V3, 28/2/22	The AQMP generally remains current but it is recommended that the plan is updated to include the substage 8A–8C scar tree survey results.
Biodiversity and Rehabilitation Management Plan (BRMP), including: Biodiversity Offset Strategy and VMP	V3.1, 23/2/22	The BRMP generally remains current it is recommended that the plan is updated to cover the remainder of the Stage 8 area and that the biodiversity offset plan is updated accordingly.

1. Some recommended actions have been commenced or completed.

Notwithstanding modifications to the various Management Plans in 2024 outlined above we will be seeking, by way of the Management Plan review process the following:

Noise monitoring: review the location of receptor sites as there has now been infill developments that render the noise assessment pointless. We will also review the frequency of the noise assessment in line with

potential revised locations and suggest that noise assessments could have a trigger function rather than just being time centric.

Dust Monitoring: review the frequency and locations taking into account there are massive subdivision developments to the North of the site that have been involving significant earthworks.

Flood Management Plan: review the FMP, specifically the TARP in line with more frequent flood events

Rehabilitation Methodology: Review the BRMP and incorporate a revised planting methodology as discussed in this review (Attachment E) as caused by recent and frequent flood events.

The SWMP will be reviewed as per EMM's recommendation - *Groundwater quality trigger values for pH are reviewed in the SWMP, ensuring all baseline data (prior to the commencement of quarrying) is considered.*

- ***report on waste minimisation and management in the Annual Review.***

The Stage 8 development generates little waste by-products. Clearing of land generates useful rehabilitation vegetation which is stored and reused. Weed residues such as Lantana and the like can be buried in the extraction hole. Any other non-organic debris that might occasionally arrive onsite via elevated river levels or floods would be taken to the site rubbish bin and removed by the regular contractor service.

- ***compliance with the performance measures, criteria and operating conditions in this consent, as they relate to the Stage 8 Area***

Every effort has been made to comply with the operating and performance measures in place in effect this Annual review is measuring operational performance over a twelve-month period and management performance leading into 2025.

The significant impact on the successful implementation of the total plan has been the impact of the May and June 2024 Nepean River floods.

There was a review of the management plans as required by Condition A29 within three months of the completion of the 2023 Annual Review and DPE feedback. Amendments were requested of the Department of Planning for most of the Management Plans and these were successfully achieved and ratified. Copies of the ratification letters have been included in the Consolidated Consent Conditions in Attachment A

A full comparison of the obligations of all the Consolidated Consent Conditions has been addressed for 2024 in Attachment A

6 Trends in performance measures, criteria and operating conditions

Identify any trends in the monitoring data/requirements over the life of the development.

Aspect	EIS Prediction	2024 Performance	Trend	Implemented Management actions
Noise	Quarterly testing	No non-compliances	Ongoing	Review management plan and frequency of monitoring
Air Quality	Dust monitoring monthly – reported on website	Generally Compliant and monitor DDG1 was relocated as it was mowing affected	Significantly large earthworks going on in Menangle Park subdivisions and may be influencing results at time – Visual dust from earthworks apparent	Monitor and record offsite dust activities that may affect results
Biodiversity/Rehab	Stages 8A and 8B in 2024, Stage 8C was predominantly rock base and limited extraction value. Commenced 8D so progress is faster than EIS prediction	Flood affected but progressed by focussing on older plants around large tree logs – 21 “clumps” located in 8A-8C	Weed and mulching thickness challenges – weed removal may take up to 7-8 separate events.	Adapted to long stem planting post floods – revise BRMP in 2025. Greater focus on native grasses
Weed Management	Measure progress	Flood affect x 2 but improved over larger area (Substage 8B & 8C)	Improving – see BRMP progress report	Vigilance and revise mulch strategy and prioritise native grasses and fast growing native bushes
Nest Boxes	44/106 installed	Added 10	Increasing rollout – usage rate is about 5.7%	Ongoing Rollout with arborist supervision – monitor for repairs and usage
Heritage	Report	No discoveries	Ongoing	Observations upon new substage clearing

Complaints	Monitor report on website	None	Continue	No Change
Groundwater	Monitor Quarterly	Quarterly testing	Continue	Review after annual report and Independent environmental audit
Water Balance	Report after 12 months data	12 month review to be completed in April 2025. Impacted by 2 flood events	Monitor water monthly until review completed	Review after annual report

Baseline data has been collected, and, in most cases, we are awaiting a 12-month cycle to make comparisons.

Dust monitoring has an initial trend is the impact of mowing and nearby construction sites on the DDG1 dust monitor. MMS intends to keep the 'front of house' tidy, bushfire ready and regularly mow. This is counterproductive on the dust monitor in summer months.

7 Predicted v Actual impact of the development

Identify any discrepancies between the predicted and actual impacts of the development and analyse the potential cause of any significant discrepancies.

There have been no significant discrepancies in terms of environmental impact apart from the flooding events and their impact on rehabilitation efforts and methodology. The rehabilitation program has been significantly impeded by two separate flood events which occurred within two months of each other which has given cause to investigate and change the planting methodology by using long stemmed more mature native species. MSS now has an onsite nursery with over 600 plants to assist with creating more flood proof rehabilitation. This is discussed in Attachments D & E.

8 Proposed Environmental Improvements

Describe what measures will be implemented over the next calendar year to improve the environmental performance of the development.

- New planting methodology to resist flood damage – 3 species focus per annum
- Ongoing nest box roll out – 44% installed currently.
- Appropriate infill planting and weed management.
- Staged rehabilitation
- Modified mulching and woody debris placement – flood tolerant.
- All recommendations provided in the Independent Audit will be addressed and completed
- A nursery was started onsite during May 2024, it currently contains 600 native plants that are being cared for and grown until matured and ready to use in rehab areas onsite. During 2025 the size of the nursery will be reviewed to increase in size to be able to hold more plants
- All management plans will be reviewed within 3 months of submitting the annual review report as per the consent

- Rehabilitation and weed management onsite will be continued
- Nestboxes will be installed as we progress through each substage
- Review the mulching strategy
- Review the frequency and locations of noise monitoring given other physical developments in the region
- Review the frequency of all monitoring activities with regard to their effectiveness and propose alternatives if necessary

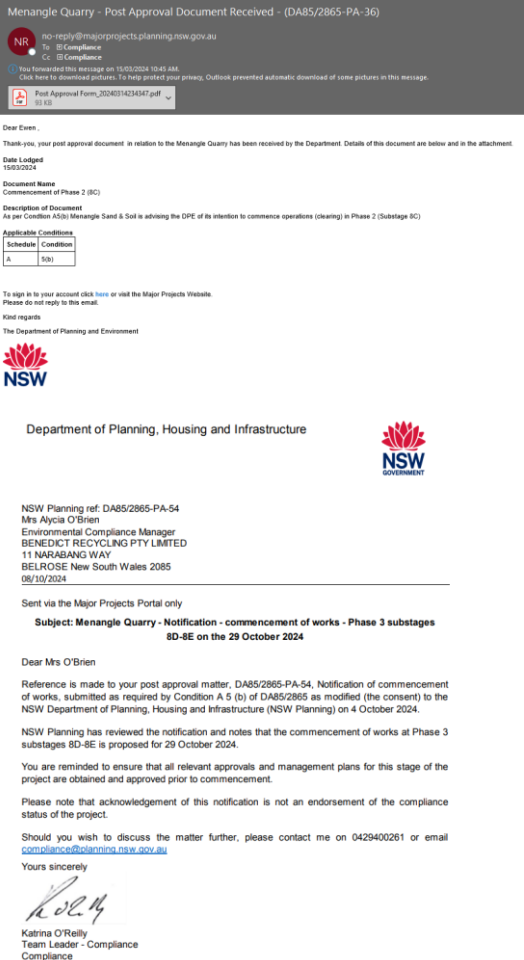
Attachments

Attachment A – Conditions Compliance Report

(b) Provide a conditions compliance report which tracks the compliance of the development with the conditions of this approval

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
A2	The conditions in this Schedule do not apply retrospective requirements in relation to Quarrying Operations undertaken in Stages 1 to 7 of the development that have been completed prior to 31 December 2020 (inclusive).	Noted	Compliant
A3	From the commencement date of construction activities associated with Stage 8 Operations, as notified under condition A5(a) of this Schedule, the obligations in Schedule 1 of this development consent will continue to apply in	Noted	Compliant



Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	relation to Stages 1 to 7 of the development, except in so far as they are specifically amended by the conditions of this Schedule.		
A4	In the event of an inconsistency, ambiguity or conflict between the conditions in Schedules 1 and 2 of this development consent, as they relate to the Stage 8 Operations, the conditions in Schedule 2 prevail to the extent of the inconsistency, ambiguity or conflict.	Noted	Compliant
A5	The Applicant must notify the Department in writing of the date of commencement of any of the following phases of the development, at least two weeks before that date:	Construction notification 20/12/22 – commenced works 16 Jan 2023 Operations commencement notification - 9/8/2023. Extraction in Substage 8A commenced 4/9/2023. Phase 2 (substage 8C) commencement notification 15/3/2024 Notification for extraction of Substages 8D & 8E occurred on 4/10/2024	Compliant
	a. construction activities associated with Stage 8 Operations;		Compliant
	b. Quarrying Operations in each of Phases 1 to 7;		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	c. cessation of Quarrying Operations (i.e. quarry closure); and		Not Triggered
	d. any period of suspension of Quarrying Operations (i.e. care and maintenance).		Not Triggered



Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
A6	In addition to meeting the specific performance measures and criteria in this consent, all reasonable and feasible measures must be implemented to prevent, and if prevention is not reasonable and feasible, minimise, any material harm to the environment that may result from the operation of the development, and any rehabilitation required under this Schedule.	Noted	Compliant
A7	The development (as modified) may only be carried out:	Noted	
	a. in compliance with the conditions of this consent;		Compliant
	b. in accordance with all written directions of the Planning Secretary; and		Compliant
	c. generally in accordance with the EIS, EA (Mod 1), Amended Project Summary and the Development Layout and Modification Report.		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
A8	Consistent with the requirements in this consent, the Planning Secretary may make written directions to the Applicant in relation to:	Noted	Compliant
	a. the content of any strategy, study, system, plan, program, review, audit, notification, report or correspondence submitted under or otherwise made in relation to this consent, including those that are required to be, and have been, approved by the Planning Secretary; and		Compliant
	b. the implementation of any actions or measures contained in any such document referred to in condition A8(a) of Schedule 2.		Compliant
A9	The conditions of this consent and directions of the Planning Secretary prevail to the extent of any inconsistency, ambiguity or conflict between them and a document/s listed in	Noted	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	condition A7(c) of Schedule 2. In the event of an inconsistency, ambiguity or conflict between any of the document/s listed in condition A7(c) of Schedule 2, the most recent document prevails to the extent of the inconsistency, ambiguity or conflict.		
A10	The Applicant must establish and maintain a Nepean River Buffer Zone during Quarrying Operations in the Stage 8 Area. This buffer zone must:	Vegetation Identification Report Approved by DPE 26/04/2022	Compliant
	a. include a minimum horizontal setback of 10 m extending landward from the 64 m AHD contour on the western side of the Nepean River;		Complaint

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	<p>b. be informed by a native vegetation identification report, which must:</p> <p>(i) be prepared by a suitably qualified and experienced botanist or ecologist, whose appointment has been endorsed by the Planning Secretary;</p> <p>(ii) include detailed site surveys to identify the DBH of all native trees that occur within the 10 m horizontal setback from the 64 m AHD contour referred to in sub-paragraph (a);</p> <p>(iii) classify all native trees identified in subparagraph (b)(ii) with a DBH of greater than or equal to 0.1 m as Protected Trees and provide their GPS coordinates; and</p> <p>(iv) include a map illustrating a 7.5 m setback (measured at the outside of the native tree trunk) around each of the identified</p>	 <p>Department of Planning and Environment</p> <p>Ms Alycia Campbell Narabang Way Belrose NSW 2085</p> <p>26/04/2022</p> <p>Dear Ms Campbell</p> <p>Menangle Quarry (DA85/2865) Spatial Survey Data – Conditions A10 and A11</p> <p>I refer to the survey plans, GPS coordinates and data files which were submitted in accordance with Condition A10(b)(v) and part of Condition A11 of Schedule 2 of the consent for Menangle Quarry (DA85/2865).</p> <p>I understand the Native Vegetation Identification Report for Substages 8A-8C (Phases 1 and 2), required under Conditions A10(a), A10(b) (i) to (iv), A10(c) and parts of Condition A11, is provided in Appendix A of the <i>Menangle Sand and Quarry Biodiversity and Rehabilitation Management Plan (BRMP)</i> (version 3.1, dated February 2022) and that the final landform for Stages 8A-8C is provided in Appendix C of BRMP to address the relevant part of Condition A11. I note the BRMP was approved by the Planning Secretary on 9 March 2022.</p> <p>Accordingly, the Planning Secretary is satisfied that the requirements of Condition A10 and A11 of Schedule 2 of DA85/2865 have been met.</p> <p>If you wish to discuss the matter further, please contact Nagindar Singh on 8289 6873 or via email at nagindar.singh@planning.nsw.gov.au.</p> <p>Yours sincerely</p>  <p>Jessie Evans Director, Resource Assessments Resource Assessments</p> <p><i>As nominee of the Planning Secretary</i></p>	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	Protected Trees; (v) the map required under subparagraph (iv) must overlay high-resolution ortho-photographs, with supporting digital terrain data files provided in spatial format for GIS and as high-resolution JPEG files; and		
	c. be amended to include the findings of the native vegetation identification report, such that it is widened to include areas where the Protected Tree setbacks extend beyond the minimum 10 m horizontal setback referred to in subparagraph (a).		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
A11	The Applicant must submit a copy of the native vegetation identification report and associated survey plans, GPS coordinates and data files required under condition A10(b) of Schedule 2 and associated final landform plans to the Planning Secretary for each of Phases 1 to 7 of the development prior to commencing any vegetation clearing or Quarrying Operations in the relevant phase.	<p>Report Approved by DPE 26/04/2022</p>  <p>Department of Planning and Environment</p> <p>Ms Alycia Campbell Narabang Way Belrose NSW 2085 26/04/2022</p> <p>Dear Ms Campbell</p> <p>Menangle Quarry (DA85/2865) Spatial Survey Data – Conditions A10 and A11</p> <p>I refer to the survey plans, GPS coordinates and data files which were submitted in accordance with Condition A10(b)(v) and part of Condition A11 of Schedule 2 of the consent for Menangle Quarry (DA85/2865).</p> <p>I understand the Native Vegetation Identification Report for Substages 8A-8C (Phases 1 and 2), required under Conditions A10(a), A10(b) (i) to (iv), A10(c) and parts of Condition A11, is provided in Appendix A of the <i>Menangle Sand and Quarry Biodiversity and Rehabilitation Management Plan</i> (BRMP) (version 3.1, dated February 2022) and that the final landform for Stages 8A-8C is provided in Appendix C of BRMP to address the relevant part of Condition A11. I note the BRMP was approved by the Planning Secretary on 9 March 2022.</p> <p>Accordingly, the Planning Secretary is satisfied that the requirements of Condition A10 and A11 of Schedule 2 of DA85/2865 have been met.</p> <p>If you wish to discuss the matter further, please contact Nagindar Singh on 8289 6873 or via email at nagindar.singh@planning.nsw.gov.au.</p> <p>Yours sincerely</p>  <p>Jessie Evans Director, Resource Assessments Resource Assessments <i>As nominee of the Planning Secretary</i></p>	Compliant
A12	With the written agreement of the Planning Secretary, the Applicant may seek to reduce the minimum 7.5 m horizontal setback distance	Noted	Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	for Protected Trees to an appropriate distance recommended by a consulting arborist assessment. Any variation request must be supported by an expert report prepared by the consulting arborist and will be determined by the Planning Secretary on a case by case basis.		
A13	The Applicant must retain and manage the minimum Nepean River Buffer Zone in accordance with the commitments in the documents listed in condition A7(c) of Schedule 2 (as may be amended by the conditions of this consent).	Noted	Compliant
A14	Prior to undertaking Quarrying Operations in Substage 8G, the Applicant must update the TUFLOW hydrodynamic model used to generate the flood sensitivity analysis in the Additional Flood Impact Sensitivity Assessment dated 17	This Condition relates to activities prior to extraction and operations in Substage 8G. This is some years away.	Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	December 2019, prepared by Advisian in the Amended Project Summary, to include the post extraction topography for Substages 8G-M, using hydraulic roughness Scenario B, and simulate the 1% AEP flood.		
A15	Prior to undertaking Quarrying Operations in Substage 8G, the Applicant must provide the Planning Secretary with a copy of the model required under condition A14 and a plan depicting any areas identified as having a post extraction 1% AEP peak flow velocity of 4 metres/second or greater.	This Condition relates to activities prior to extraction and operations in Substage 8G. This is some years away.	Not Triggered
A16	The Applicant must not carry out construction works or Quarrying Operations or locate any ancillary infrastructure within the Exclusion Areas.	Noted	Compliant
A17	The Applicant must not:	Noted	

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	a. carry out Quarrying Operations or regrading; and/or		Compliant
	b. remove vegetation, except where necessary for Weed control, within the Nepean River Buffer Zone, without the prior written agreement of the Planning Secretary.		Compliant
	The written agreement of the Planning Secretary may be provided in circumstances where those activities are necessary for environmental management purposes.		Not Triggered
A18	The Applicant must ensure that any Weed control activities undertaken within the Nepean River Buffer Zone:	Noted	Compliant
	a. are limited to Weed removal techniques that use hand-held tools; and		Compliant
	b. minimise ground disturbance to the greatest extent practicable.		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
A19	The Applicant must not undertake extraction within 7.5 m of any Protected Trees without the written agreement of the Planning Secretary under condition A12 of Schedule 2.	Noted	Not Triggered
A20	The Applicant must maintain a minimum 7.5 m setback between Quarrying Operations and any native trees a located in the Restoration Area, except where a reduced setback is supported by an assessment by a suitably qualified and experienced arborist, and evidence of this assessment has been provided to the Planning Secretary. * In this condition, the setback is to be measured from the outside of the tree trunk.	Noted	Not Triggered
A21	The Applicant must not carry out any extraction:	Noted	
	a. in Stages 1, 2, 4, 5, 6 or 7 after the date specified in		Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	condition 30 of Schedule 1; or		
	b. in Stage 3 at any time.		Compliant
A22	Prior to the commencement of Quarrying Operations in each of Phases 1 to 7, the Applicant must:	Phase 1-7 are parts of the Stage 8 area defined in the definitions. Phase 1 is substages 8A-8B. Phase 2 is substage 8C. Both these Phases have been pegged and have been documented by JMD in the Sketch of Setout Works provided as part of Appendix A of the Biodiversity and Rehabilitation Management Plan (page A12)	
	a. engage a registered surveyor to mark out the boundaries of the approved limits of extraction for the relevant Substages in each phase (as set out conceptually in the Appendix 1 and as amended by the conditions of this consent);	The survey plan for 8A and 8B was provided through the Portal to address Conditions A10 and A11 which includes the required survey GPS coordinates information.	Compliant
	b. submit a survey plan of these boundaries and their GPS coordinates to the Planning Secretary; and	The 20 protected trees are marked and listed in the BRMP page 137	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	c. ensure that these boundaries are clearly marked at all times during the life of the development in a manner that allows operating staff and inspecting officers to clearly identify those limits.		Compliant – ongoing
A23	Stage 8 Operations may be carried out on the site until 31 December 2035. Note: Under this consent, the Applicant is required to decommission and rehabilitate the site and carry out other requirements in relation to Quarrying Operations. Consequently, this consent will continue to apply in all respects other than to permit the carrying out of Quarrying Operations	Noted	Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	until the rehabilitation of the site and other requirements have been carried out to the required standard.		
A24	A maximum of 150,000 tonnes of extractive material may be extracted from the site in any calendar year.	For the calendar year 2024, 138,664 tonnes were extracted from Stage 8.	Compliant
A25	Truck movements at the site (ie inbound combined with outbound movements) must not exceed:	Truck volumes to site have been published on the Benedict website (www.benedict.com.au) A25-Truck-Movement-Summary.pdf) since January 2021. To date the truck movement volume has not exceeded the Consented number. This data has been updated every 6 months since 2021	
	a. a maximum of 248 movements on any given weekday;		Compliant
	b. an average of 148 movements per weekday, averaged on a weekly basis; and		Compliant
	c. a maximum of 80 movements per day on Saturdays.		Compliant


Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N								
A26	The Applicant must comply with Table 1: Operating Hours	Noted. General Quarry Operating hours are Mon-Fri 6am-5pm & Sat 6am-12pm	Compliant								
	<table><tr><th>Activity</th><th>Permissible Hours</th></tr><tr><td>Construction work</td><td><ul style="list-style-type: none">7 am to 5 pm Monday to Friday7 am to 1 pm SaturdayAt no time on Sundays or public holidays</td></tr><tr><td>Quarrying Operations including loading and dispatch of laden trucks</td><td><ul style="list-style-type: none">6 am to 5 pm Monday to Friday6 am to 12 noon SaturdayAt no time on Sundays or public holidays</td></tr><tr><td>Maintenance, security, office work, cleaning, etc</td><td><ul style="list-style-type: none">May be conducted at any time, provided that these activities are not audible at any residence on privately-owned land</td></tr></table>	Activity	Permissible Hours	Construction work	<ul style="list-style-type: none">7 am to 5 pm Monday to Friday7 am to 1 pm SaturdayAt no time on Sundays or public holidays	Quarrying Operations including loading and dispatch of laden trucks	<ul style="list-style-type: none">6 am to 5 pm Monday to Friday6 am to 12 noon SaturdayAt no time on Sundays or public holidays	Maintenance, security, office work, cleaning, etc	<ul style="list-style-type: none">May be conducted at any time, provided that these activities are not audible at any residence on privately-owned land		
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Maintenance, security, office work, cleaning, etc	<ul style="list-style-type: none">May be conducted at any time, provided that these activities are not audible at any residence on privately-owned land										
A27	The following activities may be carried out outside the hours specified in Table 1.	Noted									
	a. delivery or dispatch of materials as requested by Police or other public authorities; and		Not Triggered								
	b. emergency work to avoid the loss of lives, property or to prevent environmental harm.		Not Triggered								
	In such circumstances, the Applicant must notify the Department and affected		Not Triggered								

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	residents prior to undertaking the activities, or as soon as is practical thereafter.		
A28	Where conditions of this consent require consultation with an identified party, the Applicant must:	Noted	
	a. consult with the relevant party prior to submitting the subject document; and		Compliant
	b. provide details of the consultation undertaken including: (i) the outcome of that consultation, matters resolved and unresolved; and (ii) details of any disagreement remaining between the party consulted and the Applicant and how the Applicant has addressed the matters not resolved.		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
A29	The Applicant may prepare and submit the Soil and Water Management Plan and/or Biodiversity and Rehabilitation Management Plan required under conditions B36 and B73 of Schedule 2 on a staged basis, prior to the commencement of Quarrying Operations in each of Phases 1 to 7. Quarrying Operations must not commence in any phase until a management plan has been approved by the Planning Secretary for that phase.	<p>SWMP (B36) has been approved by DPE on 24/09/2021 BRMP (B73) has been approved by DPE on 9/03/2022 Published on the www.benedict.com.au website</p> <p>The Soil and Water Management Plan and Biodiversity and Rehabilitation Management Plan only apply to Substages 8A to 8C (also called Phases 1-2 in the Consent). These Plans need to be updated and approved before commencing in Substage 8D (also called Phase 3 in the Consent).</p> <p>The current plans also need to be reviewed and updated within 3 months of certain triggers (see Condition D5).</p>	
A30	With the approval of the Planning Secretary, the Applicant may:	Noted	
	a. prepare and submit any strategy, plan or program required by this consent on a staged basis (if a clear description is provided as to the specific stage and scope of the development to which		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	the strategy, plan or program applies, the relationship of the stage to any future stages and the trigger for updating the strategy, plan or program);		
	b. combine any strategy, plan or program required by this consent (if a clear relationship is demonstrated between the strategies, plans or programs that are proposed to be combined); and		Compliant
	c. update any strategy, plan or program required by this consent (to ensure the strategies, plans and programs required under this consent are updated on a regular basis and incorporate additional measures or amendments to improve the environmental performance of the development).		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
A31	If the Planning Secretary agrees, a strategy, plan or program may be approved, staged or updated without consultation being undertaken with all parties required to be consulted in the relevant condition in this consent.	Noted	Compliant
A32	Unless the Applicant and the applicable authority agree otherwise, the Applicant must:	Noted	
	a. repair, or pay the full costs associated with repairing, any public infrastructure that is damaged by carrying out the development; and		Not Triggered
	b. relocate, or pay the full costs associated with relocating, any public infrastructure that needs to be relocated as a result of the development.		Not Triggered
	Note: This condition does not apply to any damage to roads caused as a result of general road usage or		Noted

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	otherwise addressed by contributions required by condition 26 of Schedule 1.		
A33	All plant and equipment used on site, or to monitor the performance of the development must be:	Please see attached a summary of the plant and equipment maintenance planner for 2024.  A33 Maintenance chart Summary.pdf	Compliant
	a. maintained in a proper and efficient condition; and		Compliant
	b. operated in a proper and efficient manner.		Compliant
A34	The Applicant must ensure that all of its employees, contractors (and their sub-contractors) are made aware of, and are instructed to comply with, the conditions of this consent relevant to activities they carry out in respect of the development.	Noted. This has been included in site inductions	Compliant
A35	References in the conditions of this consent to any guideline, protocol, Australian Standard or policy are to such guidelines, protocols, Standards or policies in the form they are	Noted	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	in as at the date of this consent.		
A36	However, consistent with the conditions of this consent and without altering any limits or criteria in this consent, the Planning Secretary may, when issuing directions under this consent in respect of ongoing monitoring and management obligations, require compliance with an updated or revised version of such a guideline, protocol, Standard or policy, or a replacement of them.	Noted	Not Triggered
A37	Each year, from the date of commencement of Quarrying Operations in the Stage 8 Area, the Applicant must provide calendar year quarry production data to MEG by no later than 30 January.	2024 quarry production data was registered on the portal - the data was logged on 7 March 2024.	Now Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
A38	The data must be provided using the relevant standard form and a copy of the data must be included in the Annual Review.	The provision of data for the MEG was by portal. A summary of the data required is included in Section 5 of this Annual Review (above)	Compliant
A39	The Applicant must obtain all necessary approvals, licences and consents required for the carrying out of the development, including but not limited to, approvals under the Roads Act 1993, the Water Management Act 2000 and the POEO Act.	Noted	Compliant
B1	The Applicant may prepare an Early Works Construction Environmental Management Plan for the Early Works, to the satisfaction of the Planning Secretary. This plan must:	Condition B1 was originally inserted by DPE to allow some works to commence while the full management plans were being prepared/approved. It's not relevant now.	Not Triggered
	a. describe measures to be implemented to minimise construction-related impacts on biodiversity, including: (i) specific measures to minimise impacts on tree hollows, termite mounds and fauna; and		Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	(ii) detailed procedures for pre-clearance surveys and supervision (by an appropriately qualified person) of the felling of habitat trees within disturbance areas associated with the Early Works;		
	b. describe measures to be implemented to manage sediment and erosion risks, including: <ul style="list-style-type: none"> (i) a detailed description of the surface water management measures to be implemented in relation to the Early Works; and (ii) appropriate clean water diversion systems and construction of appropriate erosion and sediment controls for the management of disturbed areas associated with the Early Works; 		Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	c. include a Trigger Action Response Plan which outlines actions to be undertaken to rectify impacts associated with erosion and sedimentation during the Early Works (to the extent that these actions are not addressed by other management plans required to be in place prior to the commencement of Early Works); and		Not Triggered
	d. describe detailed procedures to be implemented to receive, record, handle and respond to complaints associated with the Early Works construction.		
B2	If the Applicant opts to seek approval for Early Works, the Applicant must not commence Early Works until the Early Works Construction Environmental Management	N/A	Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N																							
	Plan is approved by the Planning Secretary.																									
B3	If the Planning Secretary approves an Early Works Construction Environmental Management Plan, the Applicant must implement that plan as approved by the Planning Secretary.	N/A	Not Triggered																							
B4	The Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 2 at any Residence on privately-owned land. Table 2: Operational Noise Criteria dB(A)	<p>The Noise Management Plan outlines our commitments for Quarterly Noise monitoring (see pages 26 onwards).</p> <p>Quarterly Monitoring occurred in the Months of March, June, September and December in 2024.</p> <p>As outlined in Appendix 4 (3) of the Consent a Noise Compliance Assessment was conducted in the first two months of operations – A copy of this was forwarded to the EPA as required.</p>	Compliant																							
	Noise generated by the development must be measured in accordance with the relevant requirements and exemptions (including	<table> <tr> <th rowspan="2">Residences ^a</th><th>Day</th><th colspan="2">Shoulder Period 6.00 am to 7.00 am Monday to Saturday</th></tr> <tr> <th>L_{Aeq} (15 minute)</th><th>L_{Aeq} (15 minute)</th><th>L_A(max)</th></tr> <tr> <td>2, 3, 5^b, 6, 7, 8, 9</td><td>45</td><td>45</td><td>55</td></tr> <tr> <td>4</td><td>54</td><td>52</td><td>62</td></tr> <tr> <td>10, 11</td><td>35</td><td>35</td><td>45</td></tr> <tr> <td>All other Residences</td><td>35</td><td>35</td><td>45</td></tr> </table>	Residences ^a	Day	Shoulder Period 6.00 am to 7.00 am Monday to Saturday		L _{Aeq} (15 minute)	L _{Aeq} (15 minute)	L _A (max)	2, 3, 5 ^b , 6, 7, 8, 9	45	45	55	4	54	52	62	10, 11	35	35	45	All other Residences	35	35	45	
Residences ^a	Day	Shoulder Period 6.00 am to 7.00 am Monday to Saturday																								
	L _{Aeq} (15 minute)	L _{Aeq} (15 minute)	L _A (max)																							
2, 3, 5 ^b , 6, 7, 8, 9	45	45	55																							
4	54	52	62																							
10, 11	35	35	45																							
All other Residences	35	35	45																							

^a Residence locations are shown as "Assessment Locations" in Figure in Appendix 3.



^b Receiver location 5 is representative of Residences in Menangle Village as identified in the red polygon on Figure 1 in Appendix 3.

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	certain meteorological conditions) of the NSW Industrial Noise Policy (EPA, 2000). Appendix 4 sets out the meteorological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.		
B5	The noise criteria in condition B4 do not apply if the Applicant has an agreement with the owner/s of the relevant residence or land to exceed the noise criteria, and the Applicant has advised the Department in writing of the terms of this agreement.		Not Triggered
B6	The Applicant must:	Noted	
	a. take all reasonable steps to minimise all noise from operational activities, including low frequency noise and other audible characteristics, as well as		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	road noise associated with the development;		
	b. take all reasonable steps to minimise the noise impacts of the development during noise-enhancing meteorological conditions, particularly when the noise criteria in this consent do not apply (see Appendix 4);		Compliant
	c. carry out regular attended noise monitoring (every three months unless otherwise agreed with the Planning Secretary) to determine whether the development is complying with the relevant conditions of Schedule 2; and		Compliant – testing conducted during March 2024
	d. regularly assess the noise monitoring data and modify or stop operations on the site to ensure compliance with the relevant conditions of Schedule 2.		Compliant
B7	The Applicant must prepare a Noise Management Plan	Plan completed by EMM on 25/02/2022.	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	for the development to the satisfaction of the Planning Secretary. This plan must:		
	a. be prepared by a suitably qualified and experienced person/s;		Compliant
	b. be prepared in consultation with the EPA;		Compliant
	c. describe the measures to be implemented to ensure: <ul style="list-style-type: none"> (i) compliance with the noise criteria and operating conditions in this consent; (ii) best practice noise management is being employed; and (iii) noise impacts of the development are minimised during noise-enhancing meteorological conditions; under which the noise criteria in this consent do not apply (see Appendix 4); and 		Compliant



Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	d. include a monitoring program that: <ul style="list-style-type: none"> (i) is capable of evaluating the performance of the development against the noise criteria; (ii) monitors noise at the nearest and/or most affected residences; and (iii) includes a protocol for identifying any noise-related exceedance, incident or non-compliance and for notifying the Department and relevant stakeholders of these events. 		Compliant
B8	The Applicant must not commence Quarrying Operations in the Stage 8 Area until the Noise Management Plan is approved by the Planning Secretary.	Plan approved by DPE on 23/03/2022. Published on the www.benedict.com.au website.	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
		 <p>Department of Planning and Environment</p> <p>Ms Alycia Campbell Environmental Compliance Manager Benedict Recycling PTY Limited 11 Narabang Way BELROSE NSW 2085</p> <p>23/03/2022</p> <p>Dear Ms Campbell</p> <p>Menangle Quarry (DA85/2865) Noise Management Plan</p> <p>I refer to the updated Noise Management Plan which was submitted in accordance with Condition B7 of Schedule 2 of the consent for Menangle Quarry (DA85/2865).</p> <p>The Department has carefully reviewed the document and is satisfied that it generally meets the requirements of the condition.</p> <p>Accordingly, the Secretary has approved the Noise Management Plan (Revision 7, dated February 2022). Please ensure that the approved plan is placed on the project website at the earliest convenience.</p> <p>If you wish to discuss the matter further, please contact Kevin Reid on 0292746209.</p> <p>Yours sincerely</p>  <p>Jessie Evans Director, Resource Assessments Resource Assessments</p>	
B9	The Applicant must implement the Noise Management Plan as approved by the Planning Secretary.	Noted	Compliant
B10	The Applicant must ensure that no offensive odours (as defined under the POEO Act) are emitted by the development.	Noted	Compliant



Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N																			
B11	The Applicant must ensure that particulate matter emissions generated by the development do not cause exceedances of the criteria in Table 3 at any residence on privately-owned land. Table 3: Air Quality Criteria	<p>DDG1/DDG2/DDG3 have been installed. Monitoring and website posting began September 2023</p> <p>Two real-time particulate matter monitoring units initially for 2 x 4-week campaigns between Nov 2023 and Jan 2024. EMM prepared a PM 2.5 and PM 10 assessment report which was completed on 19 February 2024. (See Attachment D)</p> <p>The need to continue this real-time monitoring will be reviewed in conjunction with DPE after the 2 separate monitoring events.</p>	Compliant																			
B12	The air quality criteria in Table 3 do not apply if the Applicant has an agreement with the owner/s of the relevant residence to exceed the air quality criteria, and the Applicant has advised the Department in writing of the terms of this agreement.	<table><thead><tr><th>Pollutant</th><th>Averaging period</th><th>Criterion</th></tr></thead><tbody><tr><td rowspan="2">Particulate matter < 10 µm (PM₁₀)</td><td>Annual</td><td>^{a, c} 25 µg/m³</td></tr><tr><td>24 hour</td><td>^b 50 µg/m³</td></tr><tr><td rowspan="2">Particulate matter < 2.5 µm (PM_{2.5})</td><td>Annual</td><td>^{a, c} 8 µg/m³</td></tr><tr><td>24 hour</td><td>^b 25 µg/m³</td></tr><tr><td>Total suspended particulate (TSP) matter</td><td>Annual</td><td>^{a, c} 90 µg/m³</td></tr><tr><td>^d Deposited dust</td><td>Annual</td><td>^b 2 g/m²/month ^a 4 g/m²/month</td></tr></tbody></table> <p>Notes:</p> <p>^a Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).</p> <p>^b Incremental impact (i.e. incremental increase in concentrations due to the development on its own).</p> <p>^c Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Planning Secretary.</p> <p>^d Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method</p>	Pollutant	Averaging period	Criterion	Particulate matter < 10 µm (PM ₁₀)	Annual	^{a, c} 25 µg/m ³	24 hour	^b 50 µg/m ³	Particulate matter < 2.5 µm (PM _{2.5})	Annual	^{a, c} 8 µg/m ³	24 hour	^b 25 µg/m ³	Total suspended particulate (TSP) matter	Annual	^{a, c} 90 µg/m ³	^d Deposited dust	Annual	^b 2 g/m ² /month ^a 4 g/m ² /month	ed
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B13	The Applicant must:	Noted																				

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	a. take all reasonable steps to: <ul style="list-style-type: none"> (i) minimise odour, fume, greenhouse gas and dust (including PM10 and PM2.5) emissions of the development; (ii) minimise any visible off-site air pollution generated by the development; and (iii) minimise the extent of potential dust generating surfaces exposed in the Stage 8 Area at any given point in time; 		Compliant
	b. minimise the air quality impacts of the development during adverse meteorological conditions and extraordinary events (see Note c to Table 3 above);		Compliant
	c. carry out regular air quality monitoring to determine whether the development is complying with the relevant conditions of Schedule 2; and		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	d. regularly assess meteorological and air quality monitoring data and relocate, modify or stop operations on the site to ensure compliance with the relevant conditions of Schedule 2.		Compliant
B13A	The Applicant must construct and maintain all haul roads to minimise:	Noted – the haul roads are constructed and maintained and regularly treated by a water cart to manage dust emissions. (see Attachment I for water truck filling and water use) The soil erosion along the escarpment observed by the auditor in the Independent environmental audit 2024 has since been repaired.	
	a. excessive dust emissions by (including but not limited to): (i) sealing the road surface with a clean coarse aggregate or equivalent, and minimising the surface silt content of the roads or implementing other surface treatment options such as chemical suppressants or paving; and (ii) watering the haul roads at the appropriate water rate when in use.		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	b. erosion and sediment loss through the appropriate design and installation of drainage having regard to the Erosion and sediment control on unsealed roads A field guide for erosion and sediment control maintenance practices (OEH 2012) or latest version.		Compliant
B14	The Applicant must prepare an Air Quality Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:	<p>Plan approved by DPE 19/04/2022. Published on the www.benedict.com.au website.</p>  <p>Ms Alysia Campbell Environmental Compliance Manager Benedict Recycling PTY Limited 11 Nandang Way BELROSE NSW 2005</p> <p>19/04/2022</p> <p>Dear Ms Campbell</p> <p>Menangle Quarry - Air Quality Management Plan (DA652866) Air Quality Management Plan - Version 9</p> <p>I refer to the updated Air Quality Management Plan which was submitted in accordance with condition B14 of Schedule 2 of the consent for Menangle Quarry (DA652865).</p> <p>The Department has carefully reviewed the document and is satisfied that it generally meets the requirements of the conditions.</p> <p>Accordingly, the Secretary has approved the Air Quality Management Plan - Version 9 (dated March 2022). Please ensure that the approved plan is placed on the project website at the earliest convenience.</p> <p>If you wish to discuss the matter further, please contact Kevin Reid on 0292746209.</p> <p>Yours sincerely</p>  <p>Jessie Evans Director, Resource Assessments Resource Assessments As nominee of the Secretary</p>	Compliant
	a. be prepared by a suitably qualified and experienced person/s;		Compliant
	b. be prepared in consultation with the EPA;		Compliant
	c. describe the measures to be implemented to ensure: <ul style="list-style-type: none"> (i) compliance with the air quality criteria and operating conditions in this Schedule; (ii) best practice air 		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	quality management is being employed; and (iii) air quality impacts of the development are minimised during adverse meteorological conditions and extraordinary events; and		
	d. include an air quality monitoring program that: (i) is capable of evaluating the performance of the development against the air quality criteria; and (ii) includes a protocol for identifying any air quality-related exceedance, incident or non-compliance and for notifying the Department and relevant stakeholders of these events.		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B15	The Applicant must not commence Quarrying Operations in the Stage 8 Area until the Air Quality Management Plan is approved by the Planning Secretary.	<p>Plan approved by DPE on 19/04/2022. Published on the www.benedict.com.au website</p>  <p>Ms Alycia Campbell Environmental Compliance Manager Benedict Recycling PTY Limited 11 Narabang Way BELROSE NSW 2085</p> <p>19/04/2022</p> <p>Dear Ms Campbell</p> <p>Menangle Quarry - Air Quality Management Plan (DA85/2865) Air Quality Management Plan - Version 9</p> <p>I refer to the updated Air Quality Management Plan which was submitted in accordance with condition B14 of Schedule 2 of the consent for Menangle Quarry (DA85/2865).</p> <p>The Department has carefully reviewed the document and is satisfied that it generally meets the requirements of the conditions.</p> <p>Accordingly, the Secretary has approved the Air Quality Management Plan - Version 9 (dated March 2022). Please ensure that the approved plan is placed on the project website at the earliest convenience.</p> <p>If you wish to discuss the matter further, please contact Kevin Reid on 0292746209.</p> <p>Yours sincerely</p>  <p>Jessie Evans Director, Resource Assessments Resource Assessments</p> <p>As nominee of the Secretary</p>	Compliant
B16	The Applicant must implement the Air Quality Management Plan as approved by the Planning Secretary.	Noted	Compliant
B17	Prior to the commencement of Quarrying Operations in the Stage 8 Area, and for the life of the development, the Applicant must ensure that	Fully Installed and Operational at the site weighbridge since 3/08/2022	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	there is a suitable meteorological station operating in close proximity to the site that:		
	a. complies with the requirements in the Approved Methods for Sampling and Analysis of Air Pollutants in New South Wales (DEC, 2007); and		Compliant
	b. is capable of measuring meteorological conditions in accordance with the NSW Industrial Noise Policy (EPA, 2000), unless a suitable alternative is approved by the Planning Secretary following consultation with the EPA.		Compliant
B18	The Applicant must ensure that diesel spills and the like are cleaned up immediately so as not present a risk to water quality if the relevant Substage is inundated by floodwaters.	Noted – Part of the PIRMP process	Compliant


Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B19	The Applicant must monitor groundwater levels at Groundwater Bores BH01_S, BH01_D, BH02, BH03 and BH04 as shown in Figure 1 in Appendix 5, using continuous data loggers, for the duration of Quarrying Operations in the Stage 8 Area.	A groundwater monitoring and analysis report was prepared by EMM for 2024. (see Attachment E). Quarterly download logger data has been collected onsite and the information continually forwarded to EMM for the next annual review.	Compliant
B20	The Applicant must ensure that Quarrying Operations do not compromise the integrity of the monitoring bores identified in condition B19 of Schedule 2.	Noted	Compliant
B21	The Applicant must:	Sampling occurred four times in 2024. EMM completed an annual review for 2024 (See Attachment E)	Compliant
	a. collect groundwater quality samples at each of the monitoring locations identified in condition B19; and		
	b. analyse collected groundwater quality samples for all major anions and cations and field parameters; on an annual basis for the duration of Quarrying		

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	Operations in the Stage 8 Area.		
B22	The Applicant must ensure that:	<p>1 bore prior to start of extraction, monitored for 7 days prior to extraction, water level recorded twice a day.</p> <p>As extraction progresses, the first bore can be moved to the base of the pit and additional 1-2 bores placed in pit too. All 2-3 bores to be monitored daily while extracting.</p> <p>Bores have been drilled progressively in each substage and monitored as required (see addendum letter from recent Independent environmental audit conducted, noting compliance with this condition).</p>	Compliant
	a. temporary bores are drilled or augered progressively in each Substage to determine the local water table position immediately prior to commencing extraction in each Substage; and		Compliant
	b. the pit floor in each Substage remains at least 1 metre above the measured water table level averaged over a seven-day period following the date of drilling or augering.		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
		<p>IAN SWANE & ASSOCIATES P/L PO Box 359, MORTDALE NSW 2223</p> <p>Mob: +61 0418 867 112 Email: iswane@bigpond.com</p> <p>Benedict Industries 33 – 39 Riverside Road CHIPPING NORTON NSW 2170</p> <p>Attention: Alycia O'Brien Environmental Compliance Manager</p> <p>27 March 2025</p> <p>Dear Alycia</p> <p>ADDENDUM TO INDEPENDENT ENVIRONMENTAL AUDIT, BENEDICT MENANGLE SAND & SOIL QUARRY, 31 MENANGLE ROAD, MENANGLE NSW 2568 (43 pages)</p> <p>This letter provides Benedict Industries (Benedict) and the NSW Department of Planning, Housing and Infrastructure (DPHI) with an addendum to the independent environmental audit (IEA) issued by Ian Swane & Associates dated 14 March 2025 and titled "Benedict Menangle Sand and Soil Quarry, 31 Menangle Road, Menangle NSW 2568, Independent Environmental Audit".</p> <p>One of the conclusions made by the IEA was that no significant non-compliances were identified during the Audit Period for the Stage 8 work. The one non-compliance concerned Planning Consent Condition B22(a), which requires temporary bores to be drilled or augered progressively in each Substage to determine the local water table position immediately prior to commencing extraction in each Substage. At the time the IEA was issued, the groundwater specialist from EMM advised that no data had been provided showing that the work required by this condition had been undertaken.</p> <p>Since the IEA was issued, Benedict has provided the independent environmental auditor with data indicating that Condition B22(a) has been met. The data was provided in emails issued on 21 and 25 March 2025 and comprised:</p> <ul style="list-style-type: none"> ➤ Temporary bores had been installed in substages 8A, 8B and 8C. The well for stage 8D is soon to be installed; ➤ The wells were constructed by digging a hole and placing a 2m x 50mm pipe in the ground and then use a measuring rod to measure the deep to groundwater; ➤ A photo of temporary bore 8B is provided in Figure 1; ➤ The locations of temporary wells 8A and 8B are shown in Figure 2. Temporary well 8C hit bedrock and could not access the water table to measure the water table; and ➤ The water level elevations measured are: Well 8A 60.80 mAHD, Well 8B 60.82 mAHD, Well 8C = 60.79 mAHD (bedrock). <p>Based on this data, the independent environmental auditor considers that:</p> <ul style="list-style-type: none"> ➤ The data gap identified by EMM has been address that that "compliance ranking" for Condition 22(a) should be changed from yellow to green; and ➤ The conclusion in executive summary and Section 4.11 regarding non-compliances needs to be changed to read that no non-compliances were identified by the independent environmental audit. <p>Menangle_250327_ISAA letter</p>	
B23	The Applicant must ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of	Noted	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	the development to match its available water supply.		
B24	The Applicant must develop a groundwater model using a variant of Modflow standard software, or equivalent software, to quantify the progressive takes from water sources during Quarrying Operations in the Stage 8 Area.	Completed as part of the Soil and Water Management Plan	Compliant
B25	The Applicant must:	Completed as part of the Soil and Water Management Plan	Compliant
	a. initially construct the groundwater model required under condition B24 of Schedule 2 using the first three months of groundwater monitoring data collected from 17 June 2020 to 16 September 2020;		
	b. update the groundwater model following collection of the first 12 months of data collected from 17 June 2020 to 16 June 2021; and		Complaint
	c. incorporate the outputs of the groundwater model		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	into the Site Water Balance as required under condition B36(c)(i) of Schedule 2.		
B26	If a potential flood event (equivalent to a level of 64 m AHD at Menangle Weir, which represents the approximate height of overtopping of the Nepean River bank) does not occur between 17 June 2020 to 16 June 2021, then the Applicant must update the groundwater model required under condition B24 of Schedule 2 following the first flood event equivalent to or greater than this level when it occurs.	Completed	Compliant
B27	The Applicant must obtain any necessary Water Access Licences for the development under the Water Act 1912 and/or the Water Management Act 2000.	NSW Water Licence was renewed in June 2024 until June 2034 (copy below)	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
		<p style="text-align: center;">2</p> <div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">  <p>Natural Resources Access Regulator</p> </div> <div style="text-align: right;"> <p>Notice of Decision <i>Water Management Act 2000</i></p> </div> </div> <div style="background-color: #d3d3d3; padding: 10px; margin-top: 10px;"> <p>Application details</p> <p>Approval number CAA-2021-11223</p> <p>Application type Controlled activity approval under section 92 of the <i>Water Management Act 2000</i> for integrated development</p> <p>Description of activity Stage 8 Sand Extraction</p> <p>Applicant/s El Bethel Pty Ltd Cr. Menangle Sand & Soil Pty Ltd 11a Narabang Way Belrose NSW 2085</p> <p>Decision</p> <p>Decision Granted, subject to conditions</p> <p>This decision was made under section 95 of the <i>Water Management Act 2000</i>.</p> <p>Date of decision 11 February 2022</p> <p>Determining officer David Zerafa</p> <p>by delegation from the Minister administering the <i>Water Management Act 2000</i> under the <i>Instrument of Delegation (Water Management Act) 2011</i></p> <p>Reason/s for decision</p> <p><small>This controlled activity approval was granted on the basis that the Natural</small></p> </div>	
B28	When making an application for any necessary Water Access Licence, the Applicant must specify the annual take of water from each affected water source, as estimated by the groundwater model required under condition B24 of Schedule 2.		Compliant
B29	Should the maximum annual water take as calculated by the groundwater model increase due to subsequent revisions of the groundwater model, as required under	Noted	Not Triggered



Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	conditions B25 and B26 of Schedule 2, the Applicant must acquire the necessary additional licence shares to account for the maximum predicted annual volume.		
B30	The Applicant must report on any water captured, intercepted or extracted from the site each year (directly and indirectly) in the Annual Review, including water taken under each Water Access Licence as applicable.	The review of the water balance is an annual reporting requirement in the Soil and Water Management Plan (SWMP) and the collection of 12 months of data will occur by March 2025. A copy of the water monitoring results for March 2025 to December 2024 are attached for reference (see Attachment J)	This will be completed in April 2025 and analysis included in the 2025 Annual review
B31	The Applicant must install and maintain suitable erosion and sediment control measures in the Stage 8 Area. These measures must be designed and implemented having regard to the guidance series Managing Urban Stormwater: Soils and Construction and be detailed in the Soil and Water Management Plan required	This is ongoing and the Rehabilitation and Restoration Annual Progress Report (see Attachment D) included Attachment A which monitors and records drainage, erosion and sediment control inspections.	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	under condition B36 of Schedule 2.		
B32	The Applicant must prepare a Flood Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:	Plan completed by EMM on 25 February 2022	Compliant
	a. be prepared by suitably qualified and experienced person/s;		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	<p>b. identify measures to:</p> <ul style="list-style-type: none"> (i) proactively prepare for, and respond to, any flood event in which the active extraction area is likely to be inundated by floodwaters emanating from the Nepean River; (ii) ensure the safety of site personnel; (iii) minimise, to the greatest extent practicable, the areas of exposed ground on the site that would be susceptible to flood risks (including scour and erosion and potential transport of sediment to downstream waters); (iv) ensure that the active extraction area in any Substage does not exceed 0.33 hectares at any one time; (v) ensure that the batter adjacent to the Nepean River Buffer Zone does not exceed: <ul style="list-style-type: none"> • a maximum 		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	<p>slope of 1:1 at any time; and</p> <ul style="list-style-type: none"> a maximum slope of 1:5 in preparation for flood events; <p>(vi) ensure that no more than a 30 metres length of the batter adjacent to the Nepean River Buffer Zone (measured in total) has a slope exceeding 1:5 at any one time; and</p> <p>(vii) rectify any flood-related damage to areas undergoing rehabilitation; and</p>		
	<p>c. include a Trigger Action Response Plan which outlines actions to be undertaken in preparation for, and immediately following, a flood event including detailed protocols and timeframes for:</p> <p>(i) backfilling the active extraction area to achieve a maximum batter slope of 1:5 adjacent to the Nepean River</p>		Compliant and Triggered in 2024 x 2

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	Buffer Zone in preparation for flood events; (ii) avoiding the downstream movement of debris from the site; (iii) recommencing Quarrying Operations following a flood event; and (iv) rectifying any damage to areas undergoing rehabilitation following a flood event.		

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B33	The Applicant must not commence Quarrying Operations in the Stage 8 Area until the Flood Management Plan is approved by the Planning Secretary.	<p>Plan approved by DPE on 9/4/2021. Revised version approved 25/10/2022. Published on the www.benedict.com.au website</p> <p>Department of Planning and Environment</p> <p> Our ref: (DA952985-PA-26)</p> <p>Ms. Alysia Campbell Environmental Compliance Manager Benedict Recycling PTY Limited 11 Narabang Way BELMORE NSW 2065</p> <p>25/10/2022</p> <p>Subject: Revised Flood Management Plan for Menangle Quarry (Condition B32 of DA952985)</p> <p>Dear Ms. Campbell</p> <p>I refer to your submission requesting approval of the revised Flood Management Plan (Version 3, dated February 2022) which was submitted following modification 2 of the development consent and in accordance with Condition B32 of Schedule 2 (DA952985).</p> <p>I also acknowledge your representatives' recent email (EMM Consulting) to the Department on 14 October 2022 confirming that the criteria presented in Table 5.2 detailing the flood scour risk and remedial responses are consistent with the information provided to NSW Natural Resources Access Regulator, as part of the Controlled Activity Approval (CAA-2021-11223) issued on 14 February 2022.</p> <p>I therefore approve the revisions to the management plan.</p> <p>You are reminded that if there is any inconsistency between the approved document and the conditions of consent, then the requirements of the conditions of consent prevail.</p> <p>If you wish to discuss the matter further, please contact Kevin Reid on 02 927 40209 or via email kevin.reid@dpe.nsw.gov.au</p> <p>Yours sincerely</p> <p></p> <p>Carl Dupleston Team Leader Resource Assessments</p> <p>4 Parramatta Square, 12 Derry Street, Parramatta NSW 2150 Locked Bag 9022, Parramatta NSW 2124 www.dpe.nsw.gov.au</p>	Compliant
B34	The Applicant must implement the Flood Management Plan as approved by the Planning Secretary.	Noted	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N																																																																																																																																																																	
B35	The Applicant must ensure that the flood storage capacity of the final rehabilitated landform is no less than the pre-existing flood storage capacity at all stages of the development, unless otherwise approved in writing by the Planning Secretary. Details of the available flood storage capacity must be reported in the Annual Review.	<p>The completed substages 8A – 8C have an average of 3.31m increase in flood storage capacity. Specific measurements are attached below</p> <table><tr><td></td><td></td><td></td><td colspan="3">Menangle Levels pre and post levels.</td><td></td></tr><tr><td>Stage</td><td>Easterly</td><td>Northerly</td><td>pre levels</td><td>post levels</td><td>levels</td><td></td></tr><tr><td>8A</td><td>292947.75</td><td>6221754.13</td><td>67.84</td><td>65.79</td><td>2.08</td><td></td></tr><tr><td>8A</td><td>292927.33</td><td>6221705.85</td><td>68.62</td><td>63.91</td><td>4.71</td><td></td></tr><tr><td>8A</td><td>292903.22</td><td>6221668.93</td><td>68.74</td><td>63.97</td><td>4.77</td><td></td></tr><tr><td>8A</td><td>292881.52</td><td>6221645.42</td><td>69.22</td><td>64.12</td><td>5.1</td><td></td></tr><tr><td>8A</td><td>292868.19</td><td>6221621.94</td><td>68.76</td><td>64.43</td><td>4.33</td><td></td></tr><tr><td>8A</td><td>292856.49</td><td>6221591.68</td><td>69.86</td><td>64.71</td><td>5.15</td><td></td></tr><tr><td>8B</td><td>292840.57</td><td>6221560.57</td><td>68.96</td><td>65.28</td><td>3.68</td><td></td></tr><tr><td>8B</td><td>292844.13</td><td>6221533.38</td><td>66.64</td><td>64.71</td><td>1.93</td><td></td></tr><tr><td>8B</td><td>292831.06</td><td>6221496.45</td><td>70.24</td><td>66.54</td><td>3.74</td><td></td></tr><tr><td>8C</td><td>292832.216</td><td>6221458.07</td><td>69.45</td><td>66.31</td><td>3.14</td><td></td></tr><tr><td>8C</td><td>292824.597</td><td>6221387.06</td><td>66.75</td><td>63.98</td><td>2.77</td><td></td></tr><tr><td>8C</td><td>292795.185</td><td>6321388.39</td><td>67.38</td><td>65.34</td><td>2.04</td><td></td></tr><tr><td>8C</td><td>292758.228</td><td>6221298.53</td><td>66.88</td><td>65.28</td><td>1.6</td><td></td></tr><tr><td>8C</td><td>292720.498</td><td>6221259.93</td><td>67.34</td><td>66.02</td><td>1.32</td><td></td></tr><tr><td></td><td></td><td></td><td></td><td>Average post levels</td><td>3.31</td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>Water sump</td><td></td><td>Sump level</td><td>River level</td><td></td><td></td></tr><tr><td>8A</td><td>292937.93</td><td>6221702.98</td><td>60.8</td><td>60.9</td><td></td><td></td></tr><tr><td>8B</td><td>292849.76</td><td>6221550.68</td><td>60.82</td><td>60.89</td><td></td><td></td></tr><tr><td>8C</td><td>292842.31</td><td>6221435.04</td><td>60.79</td><td>60.88</td><td></td><td></td></tr><tr><td>8D</td><td>292610.35</td><td>6220746.97</td><td>60.83</td><td>60.91</td><td></td><td></td></tr></table>				Menangle Levels pre and post levels.				Stage	Easterly	Northerly	pre levels	post levels	levels		8A	292947.75	6221754.13	67.84	65.79	2.08		8A	292927.33	6221705.85	68.62	63.91	4.71		8A	292903.22	6221668.93	68.74	63.97	4.77		8A	292881.52	6221645.42	69.22	64.12	5.1		8A	292868.19	6221621.94	68.76	64.43	4.33		8A	292856.49	6221591.68	69.86	64.71	5.15		8B	292840.57	6221560.57	68.96	65.28	3.68		8B	292844.13	6221533.38	66.64	64.71	1.93		8B	292831.06	6221496.45	70.24	66.54	3.74		8C	292832.216	6221458.07	69.45	66.31	3.14		8C	292824.597	6221387.06	66.75	63.98	2.77		8C	292795.185	6321388.39	67.38	65.34	2.04		8C	292758.228	6221298.53	66.88	65.28	1.6		8C	292720.498	6221259.93	67.34	66.02	1.32						Average post levels	3.31										Water sump		Sump level	River level			8A	292937.93	6221702.98	60.8	60.9			8B	292849.76	6221550.68	60.82	60.89			8C	292842.31	6221435.04	60.79	60.88			8D	292610.35	6220746.97	60.83	60.91			Compliant
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B36	<p>The Applicant must prepare a Soil and Water Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:</p> <p>a. be prepared by suitably qualified and experienced person/s;</p> <p>b. be prepared in consultation with EPA and DPIE Water; and</p>	Plan completed by EMM on 25/02/2022.	Compliant																																																																																																																																																																	
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Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	<p>c. include a:</p> <p>i. Site Water Balance that:</p> <ul style="list-style-type: none">includes details of:<ul style="list-style-type: none">sources and security of water supply;water use and management on the site;reporting procedures, including the annual preparation of a site water balance; andminimises clean and potable water use on the site;incorporates the outputs of the groundwater water model required under condition B24 of Schedule 2;		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	<p>ii. Surface Water Management Plan, that includes:</p> <ul style="list-style-type: none"> • detailed baseline data on surface water flows and quality in watercourses and/or water bodies that could potentially be affected by the development; • surface water impact assessment criteria, including trigger levels for investigating any potentially adverse impacts, and surface water management performance measures; • a detailed description of the surface water management system on the site, including the: <ul style="list-style-type: none"> - clean water diversion system; - erosion and sediment controls (including the construction of bunds and swales within each Substage); and - water storages (including a description of 		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	<p>measures to maintain the storage capacity of sediment basins);</p> <ul style="list-style-type: none"> • a program to monitor and report on: <ul style="list-style-type: none"> - any surface water discharges; - the effectiveness of the water management system; - surface water quality in sediment basins; and <ul style="list-style-type: none"> - water levels and quality in the Nepean River both upstream and downstream of the site; and • a protocol for identifying and investigating any exceedances of the surface water impact assessment criteria and for notifying the Department and relevant stakeholders of these events; 		



Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	<p>iii. Groundwater Management Plan that includes:</p> <ul style="list-style-type: none"> • all available baseline data for the site; • groundwater performance criteria, including trigger levels for investigating any potentially adverse groundwater impacts, particularly with respect to aquatic habitat and regional groundwater systems; • a protocol to ensure that Quarrying Operations do not exceed the extraction depth limit specified in condition B22(b) of Schedule 2; • measures to ensure that the integrity of the groundwater monitoring network is not compromised by Quarrying Operations; • a clear description of the reporting processes and procedures to be adopted for the routine 		Compliant



Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	collation, analysis and provision of monitoring data as required under conditions B21 and B22 of Schedule 2; and <ul style="list-style-type: none"> a protocol for identifying and investigating any exceedances of the groundwater performance criteria and for notifying the Department and relevant stakeholders of these events. 		
B37	Subject to condition A29, the Applicant must not commence Quarrying Operations in the Stage 8 Area until the Soil and Water Management Plan is approved by the Planning Secretary.	Plan approved by DPE on 25/03/2022. Published on the www.benedict.com.au website.	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
		 <p> Mr Alycia Campbell Environmental Compliance Manager Benedict Recycling PTY Limited 11 HARRISBURG WAY BELROSE NSW 2065 </p> <p>25/03/2022</p> <p>Dear Mr Campbell</p> <p style="text-align: center;"> Menangle Quarry (DA 852895) Soil and Water Management Plan - Version 3 </p> <p>I refer to the updated Soil and Water Management Plan - Version 3 which was submitted in accordance with Condition 83B of Schedule 2 of the consent for Menangle Quarry (DA 852895).</p> <p>The Department has carefully reviewed the document and is satisfied that it is satisfied that it generally meets the requirements of the conditions.</p> <p>Accordingly, the Secretary has approved the Soil and Water Management Plan (Revision 3, dated February 2022). Please ensure that the approved plan is placed on the project website at the earliest convenience.</p> <p>If you wish to discuss the matter further, please contact Kevin Field on 0292746209.</p> <p>Yours sincerely</p>  <p> Jessie Evans Director, Resource Assessments Resource Assessments As nominee of the Secretary </p>	
B38	The Applicant must implement the Soil and Water Management Plan approved by the Planning Secretary.	Noted	Compliant
B39	The Applicant must ensure that all surface discharges from the site comply with the relevant provisions of the POEO Act.	Noted	Compliant
B40	The Applicant must prepare an Ephemeral Creek Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:	The Ephemeral Creek Management Plan has now been completed and appended to the SWMP as part of the 2024 Management Plan Review. Approval as per below	Completed

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	a. be prepared by suitably qualified and experienced person/s whose appointment has been endorsed by the Planning Secretary;		Completed
	b. describes the measures that would be implemented to manage and control soil erosion and bank stabilisation (if required) and limit the risk of impacts on downstream receiving environments;		Completed
	c. provide details of the methods and timing of extraction within Substages 8E, 8F or 8G that demonstrate the integrity of the ephemeral creek (shown conceptually in Figure 5 of Appendix 1) would be maintained for as long as practicable during operations;		Completed
	d. provide for construction and stabilisation of appropriate diversion channels to divert		Completed

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	surface water flows around the disturbance area, unless otherwise approved by the Planning Secretary;		
	e. provide final designs for the road crossing and realigned section of creek that are supported by hydrological modelling and meet the rehabilitation objectives in Table 4; and		Completed
	f. describe the methods and timing for rehabilitation of the final realigned section of creek channel.		Not Triggered
B41	The Applicant must not undertake any construction activities or Quarrying Operations within Substages 8E, 8F or 8G until the Ephemeral Creek Management Plan is approved by the Planning Secretary.	Noted	Not Triggered



Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B42	The Applicant must implement the Ephemeral Creek Management Plan approved by the Planning Secretary.	<p>Department of Planning, Housing & Infrastructure</p>  <p>Our ref: DA85/2865-PA-42</p> <p>Ewen McKenzie Acting Environmental and Compliance Manager BENEDICT RECYCLING PTY LIMITED 11 NARABANG WAY BELROSE, New South Wales 2085</p> <p>20/09/2024</p> <hr/> <p>Subject: Updated Soil and Water Management Plan and component Ephemeral Creek Management Plan</p> <p>Dear Mr McKenzie</p> <p>I refer to the updated Soil and Water Management Plan version 5 (SWMP), and component Ephemeral Creek Management Plan (ECMP), submitted in accordance with the relevant conditions of consent.</p> <p>I note the plans have been updated to include extraction stages 8D to 8M and in response to matters raised by the Department during its review. I note both plans have been prepared and updated by suitably qualified persons at EMM consulting, Tooker and Associates and GRC Hydro.</p> <p>I have reviewed both plans and consider the amendments made to the SWMP and the new ECMP address the relevant conditions of consent, accordingly I approve both plans.</p> <p>If you wish to discuss the matter further, please contact me by email: carl.dumpleton@planning.nsw.gov.au.</p> <p>Yours sincerely</p>  <p>Carl Dumpleton – Team Leader Resources and Assessments As nominee of the Planning Secretary</p>	Noted

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B43	Prior to commencing Quarrying Operations in the Stage 8 Area, the Applicant must make an application to TfNSW under Section 138 of the Roads Act 1993 for any proposed works within the Hume Highway Motorway Road Reserve (including the area under the Menangle Bridges).	<p>WAD # SYD17/00793/04 between TfNSW & MSS was completed with construction securities accepted on 7 December 202</p>  <p>BANK GUARANTEE</p>  <p>2</p>	Compliant
B44	The Applicant must enter into a legally binding agreement with TfNSW (eg a licence, not a lease or an easement), for the operation and ongoing maintenance of the section of the haul road and associated infrastructure within the Hume Highway Motorway Road Reserve (including under the Menangle Bridges). The legally binding agreement must be executed prior to any construction within the road reserve. All TfNSW legal	WAD as above	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	costs associated with drafting and executing the legally binding agreement must be borne by the Applicant.		
B45	The Applicant must:	WAD as above	
	a. provide an appropriately designed sealed access under and adjacent to the Menangle Bridges and comply with TfNSW drainage and pavement standards;		Compliant
	b. Deleted		
	c. provide unrestricted access to TfNSW to undertake maintenance on the Menangle Bridges and associated facilities at all times;		Compliant
	d. remove any detritus associated with the construction and use of the access and haul road under and adjacent to the Menangle Bridges; and		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	e. protect the piers of the Menangle Bridges, as well as any other part of the bridge structure and associated facilities from any potential damage as a result of the development;		Compliant
B46	In making the application to TfNSW required under condition B43, the Applicant must provide:	WAD as above	
	a. details demonstrating how the requirements in condition B45 will be met during the early establishment phase of the development, including: (i) sealing and drainage design details for the access road under and adjacent to the Menangle Bridges; and (ii) anchoring details for any structure(s) associated with the development that may become floating debris during flood events; and		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	b. details demonstrating how the compliance with the requirements in condition B45 will be maintained over the life of the development.		Compliant
B47	The Applicant must ensure that works undertaken within the Hume Highway Motorway Road Reserve do not in any way destabilise the foundations of the Hume Highway, including the Menangle Bridges. Should rectification works be required as a result of the development, they must be undertaken by the Applicant in accordance with TfNSW requirements and standards, and at no expense to TfNSW.	Noted	Compliant
B48	The Applicant must not undertake any works within the Hume Highway Motorway Road Reserve (including the area under the Menangle Bridges) without the consent of TfNSW under Section 138 of the Roads Act 1993.	WAD – TfNSW gave construction approval on 13 December 2022	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B49	Within 12 months of commencing Quarrying Operations in the Stage 8 Area, and every five years thereafter until the conclusion of Quarrying Operations, the Applicant must undertake a Road Safety and Condition Audit for the development, to the satisfaction of the Planning Secretary. This Audit must:	– The Road Safety and Condition Audit was submitted on 9 December 2024 and Conditionally approved on 6 February 2025	Not Triggered
	a. be undertaken by a suitably qualified independent expert/s whose appointment has been endorsed by the Planning Secretary;	<p>Department of Planning, Housing & Infrastructure</p>  <p>Our ref: DA85/2865-PA-56</p> <p>Ms Alycia O'Brien Environmental Compliance Manager 11 NARABANG WAY BELROSE NSW 2085 06/02/2025</p> <p>Subject: Condition B49 – Road Safety and Condition Audit</p> <p>Dear Ms O'Brien</p> <p>I refer to your submission of the Road Safety and Condition Audit, dated 9 December 2024, prepared by EMM consulting. The Department has reviewed the report and considers that it meets the requirements of condition B49 of the consent.</p> <p>The report identifies that at the site entrance, for heavy vehicles exiting the site, the:</p> <ol style="list-style-type: none"> stop signs are faded and would benefit with replacing; and stop line marking is missing and the report recommends this be installed. <p>Condition 21 of the consent requires the site entrance be maintained. Given both items form part of the site entrance, it is requested you install these items within 3 months of the date of this letter.</p> <p>If you wish to discuss the matter further, please contact Carl Dumbleton (Team Leader, Resources and Energy Assessments), on 9228 6283 or carl.dumbleton@planning.nsw.gov.au</p> <p>Yours sincerely</p>  <p>Jessie Evans, Director Resources and Energy As nominee of the Planning Secretary</p>	Not Triggered
	b. be prepared in consultation with Council;		Not Triggered
	c. assessment the safety, performance and condition of the site's vehicular access onto Menangle Road, including the associated acceleration and deceleration lanes;	The two Conditions were completed and the DPE advised on 28 February 2025.	Not Triggered



Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	d. identify any road works that are required to ensure compliance with relevant Austroads standards or relevant Council requirements;		Not Triggered
	e. be documented in a Road Safety and Condition Audit Report which must be submitted to Council and the Planning Secretary for approval within three months of commencing the Audit.		Not Triggered
B50	Within 12 months of completing each Road Safety and Condition Audit required under condition B49 of this Schedule, unless otherwise agreed by the Planning Secretary, the Applicant must complete any road works recommended in the Audit, to the satisfaction of Council. If there is a dispute regarding the implementation of any recommendations contained in the Audit, the Applicant	Noted	Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	may refer the matter to the Planning Secretary for resolution.		
B51	For the duration of the Stage 8 Operations, the Applicant must continue to pay Council a rehabilitation levy on all sand and soil removed from the Stage 8 Area in accordance with the existing rates, calculation methods and indexation required under condition 26 of Schedule 1. The first instalment of these payments is to be made based on the most recent Index Review Date under Schedule 1.	Noted – The Trust Deed is currently being negotiated between MSS and DPE and currently is with DPE	Compliance being sought
B52	The Applicant must keep accurate records of all truck movements to and from the site (including time of arrival and dispatch) and publish a	Weighbridge data is collected for each truck movement. A summary of the truck movements is published on the website (see: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.benedict.com.au/wp-content/uploads/A25-truck-movement.pdf)	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	summary of records on its website every 6 months.		
B53	No direct access to or from the development via the Hume Highway is permitted.	Noted	Compliant
B54	The Applicant must:	Noted	
	a. ensure that all laden trucks entering or exiting the site have their loads covered;		Compliant
	b. ensure that all laden trucks exiting the site are cleaned of material that may fall from vehicles, before leaving the site;		Compliant
	c. take all reasonable steps to minimise traffic safety issues and disruption to local road users; and		Compliant
	d. take all reasonable steps to ensure that appropriate signage is displayed on all trucks used to transport quarry products from the development so they can be easily identified by other road users.		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B54A	The Applicant must:	Noted	
	a. prevent headlights from the off-road haul truck impacting upon the Hume Motorway; and		Compliant
	b. ensure the off-road haul truck operating within the site is restricted to a travel speed of 20 km/hour or less.		Compliant
B55	The Applicant must prepare a Traffic Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:	Completed by EMM v7 February 2022	
	a. be prepared by suitably qualified and experienced person/s whose appointment has been endorsed by the Planning Secretary;		Compliant
	b. be prepared in consultation with TfNSW and Wollondilly Shire and Campbelltown Councils;		Compliant
	c. include details of all transport routes and traffic		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	types to be used for development-related traffic;		
	d. describe the processes in place for the control of truck movements entering and exiting the site;		Compliant
	e. include details of the measures to be implemented to minimise traffic safety issues and disruption to local road users;		Compliant
	f. include a Drivers' Code of Conduct that includes procedures to ensure that drivers: (i) adhere to posted speed limits or other required travelling speeds; (ii) adhere to designated transport routes; and (iii) implement safe and quiet driving practices;		Compliant
	g. describe the measures to be put in place to ensure compliance with the Drivers' Code of Conduct; and		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	h. describe measures to minimise the transmission of dust and tracking of material onto the surface of public roads from vehicles exiting the site; and		Compliant
	i. describe measures to be put in place to ensure the off-road haul truck complies with its operating conditions.		Compliant
B56	The Applicant must not commence Quarrying Operations in the Stage 8 Area until the Traffic Management Plan is approved by the Planning Secretary.	<p>Approved by DPE on 23/03/2022. Published on website https://www.benedict.com.au/wp-content/uploads/J190166_24_MSS_Traffic-MP_v7.pdf</p>  <p>Ms Alycia Campbell Operations Planning Support Manager Benedict Recycling PTY LIMITED 11 Narabang Way BELROSE NSW 2085</p> <p>23/03/2022</p> <p>Dear Ms Campbell</p> <p style="text-align: center;">Menangle Quarry (DA85/2865) Traffic Management Plan</p> <p>I refer to the updated Traffic Management Plan which was submitted in accordance with Condition B54A and B55(i) of Schedule 2 of the consent for the Menangle Quarry (DA85/2865).</p> <p>The Department has carefully reviewed the document and is satisfied that it generally meets the requirements of the conditions.</p> <p>Accordingly, the Secretary has approved the Traffic Management Plan (Revision 7, dated February 2022). Please ensure that the approved plan is placed on the project website at the earliest convenience.</p> <p>If you wish to discuss the matter further, please contact Kevin Reid on 0292746209.</p> <p>Yours sincerely</p>  <p>Jessie Evans Director, Resource Assessments Resource Assessments As nominee of the Secretary</p>	Compliant



Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B57	The Applicant must implement the Traffic Management Plan as approved by the Planning Secretary.	Noted	Compliant
B58	The Applicant must ensure that the development does not cause any direct or indirect impact on any identified heritage item located outside the approved disturbance area.	Noted	Compliant
B59	If suspected human remains are discovered on site, then all work surrounding the area must cease, and the area must be secured. The Applicant must immediately notify NSW Police and Heritage NSW, and work must not recommence in the area until authorised by NSW Police and Heritage NSW.	Noted	Not Triggered
B60	If any previously unknown Aboriginal object or Aboriginal place is discovered in the Stage 8 Area:	Noted	Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	a. all work in the immediate vicinity of the object or place must cease immediately;		Not Triggered
	b. a 10 metre buffer area around the object or place must be cordoned off; and		Not Triggered
	c. Heritage NSW must be contacted immediately.		Not Triggered
B61	Work in the immediate vicinity of an object or place subject to condition B60 may only recommence if:	Noted	Not Triggered
	a. the potential Aboriginal object or Aboriginal place is confirmed by Heritage NSW upon consultation with the Registered Aboriginal Parties not to be an Aboriginal object or Aboriginal Place; or		Not Triggered
	b. an Aboriginal Heritage Impact Permit is obtained under section 90 of the National Parks and Wildlife Act 1974, and the Aboriginal Cultural Heritage Management Plan is revised to include appropriate measures in respect the		Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	Aboriginal object or Aboriginal place, to the satisfaction of the Planning Secretary.		
B62	The Applicant must prepare an Aboriginal Cultural Heritage Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:	Completed by EMM v3 February 2022	Compliant
	a. be prepared by suitably qualified and experienced person/s whose appointment has been endorsed by the Planning Secretary;		Compliant
	b. be prepared in consultation with Heritage NSW and Registered Aboriginal Parties;		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	<p>c. describe the measures to be implemented within the Stage 8 Area, Nepean River Buffer Zone and Restoration Area to:</p> <ul style="list-style-type: none"> (i) ensure all workers on the site receive suitable Aboriginal cultural heritage inductions prior to carrying out any activities which may cause impacts to Aboriginal objects or Aboriginal places, and that suitable records are kept of these inductions; (ii) protect, monitor and manage Aboriginal objects and Aboriginal places; (iii) protect Aboriginal objects and Aboriginal places located outside the approved disturbance area from impacts of the development; (iv) manage any new Aboriginal objects or Aboriginal places discovered during the life of the development; 		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	(v) maintain and manage reasonable access for relevant Aboriginal stakeholders to Aboriginal objects and Aboriginal places (outside of the approved disturbance area); and (vi) facilitate ongoing consultation and involvement of Registered Aboriginal Parties in the conservation and management of Aboriginal cultural heritage on the site.		
B63	The Applicant must not commence Quarrying Operations in the Stage 8 Area until the Aboriginal Cultural Heritage Management Plan is approved by the Planning Secretary.	Approved by DPE on 25/03/2022. Published on the website https://www.benedict.com.au/about/policies-compliance/	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
		 <p>Ms Alycia Campbell Environmental Compliance Manager Benedict Recycling PTY Limited 11 NARABANG WAY BELROSE NSW 2085</p> <p>25/03/2022</p> <p>Dear Ms Campbell</p> <p>Menangle Quarry (DA85/2865) Aboriginal Heritage Management Plan - Version 3</p> <p>I refer to the updated Aboriginal Heritage Management Plan - Version 3 which was submitted in accordance with Conditions B58-B64 of Schedule 2 of the consent for the Menangle Quarry (DA85/2865).</p> <p>The Department has carefully reviewed the document and is satisfied that it generally meets the requirements of the conditions.</p> <p>Accordingly, the Secretary has approved the Aboriginal Heritage Management Plan - Version 3 (Revision 3, dated February 2022). Please ensure that the approved plan is placed on the project website at the earliest convenience.</p> <p>If you wish to discuss the matter further, please contact Kevin Reid on 02 92746209.</p> <p>Yours sincerely</p>  <p>Jessie Evans Director, Resource Assessments Resource Assessments As nominee of the Secretary</p>	
B64	The Applicant must implement the Aboriginal Cultural Heritage Management Plan approved by the Planning Secretary.	Noted	Compliant
B65	Prior to commencing construction of any linear infrastructure required for the carrying out of the development (including conveyors, access roads and haul roads), the Applicant must:	Existing tracks are being used, and no additional clearing will be required, therefore, there will be no need to survey, map vegetation or provide offsets.	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	a. determine the final alignment of the linear infrastructure by survey;		Not Triggered
	b. minimise the environmental impacts of the alignment of this infrastructure, where practicable;		Not Triggered
	c. map the final vegetation clearance, excluding any vegetation within the approved disturbance area as identified under condition A22 of Schedule 2;		Not Triggered
	d. submit a survey plan of the disturbance boundaries for linear infrastructure and their respective GPS coordinates to the Planning Secretary; and		Not Triggered
	e. identify relevant ecosystem and species credits required to compensate for the clearance identified in subparagraph (c), to the satisfaction of BCD.		Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B66	The Applicant must retire the ecosystem and species credits identified under condition B65(e) in accordance with the Biodiversity Offsets Scheme of the BC Act, to the satisfaction of the BCT.	Not required if there is no clearing.	Not triggered
B67	Prior to commencing Quarrying Operations in the Stage 8 Area, or other timeframe agreed by the Planning Secretary, the Applicant must make suitable arrangements for the long-term protection of the Restoration Area as described in the documents listed in condition A7(c) of Schedule 2, to the satisfaction of the Planning Secretary.	This process commenced in February of 2023 and remains an ongoing legal negotiation at the time of this review.	Seeking Compliance
B68	If the Restoration Area does not meet the listing criteria of the targeted communities or the completion criteria in Table 6 in Appendix 7, within the timeframes established in the Biodiversity and	Noted	Not triggered



Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	Rehabilitation Management Plan, then the Applicant must retire the relevant deficient biodiversity credits in accordance with the Biodiversity Offsets Scheme of the BC Act, to the satisfaction of the BCT.		
B69	The Applicant may satisfy condition B67 of Schedule 2 by establishing a positive covenant on title under section 88E of the NSW Conveyancing Act 1919. If the Applicant seeks to establish a positive covenant on title:	Noted as per B67	
	a. the positive covenant must stipulate that the Applicant will manage the Restoration Area and all rehabilitated Substages in accordance with the Biodiversity and Rehabilitation Management Plan required under condition B73 of Schedule 2; and		

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	b. the Applicant must establish a trust with sufficient funds (calculated in accordance with the total fund deposit requirements for a biodiversity stewardship site in accordance with BC Act) to provide for the ongoing management of the Restoration Area and all rehabilitated Substages in accordance with the Biodiversity and Rehabilitation Management Plan, to the satisfaction of the Planning Secretary.		

B70	The Applicant must rehabilitate all areas impacted by the Stage 8 Operations to the satisfaction of the Planning Secretary. This rehabilitation must be consistent with the final rehabilitation plans submitted to the Planning Secretary under condition A11 of Schedule 2 and must comply with the objectives in Table 4, to the satisfaction of the Planning Secretary. Table 4: Rehabilitation objectives	Noted – subject to the Annual Review process	Not Triggered														
		<table><tr><th>Feature</th><th>Objective</th></tr><tr><td>Stage 8 Area</td><td><ul style="list-style-type: none">Safe (both within the site and in relation to downstream environs, including under flood conditions)Hydraulically, geotechnically and geomorphologically stableNon-pollutingFit for the intended post-Quarrying Operations land use(s)Final landform integrated with surrounding natural landforms as far as is reasonable and feasible, and minimising visual impacts when viewed from surrounding land or the Hume Highway</td></tr><tr><td>Surface infrastructure</td><td><ul style="list-style-type: none">Infrastructure within the Hume Motorway road reserve (including the area under the Menangle Bridges) decommissioned and rehabilitated in accordance with TfNSW requirementsAll other surface infrastructure decommissioned and removed, unless otherwise agreed by the Planning Secretary</td></tr><tr><td>Quarry Substages</td><td><ul style="list-style-type: none">Pit floor partially backfilled with sufficient and appropriate material to promote establishment of River-Flat Eucalypt Forest EECSubstages progressively landscaped and vegetated to meet the objectives, performance and completion criteria in Table 6 in Appendix 7Batters to be established to a maximum slope of 1:1 (V:H) along the landward edge of each Substage and 1:5 (V:H) adjacent to the Nepean River Buffer Zone</td></tr><tr><td>Final Landform</td><td><ul style="list-style-type: none">No reduction in flood storage capacity, compared with pre-development conditions, unless otherwise agreed by the Planning SecretaryDesigned to incorporate geomorphological features to allow for the free draining discharge of clean water from the siteMinimise sediment laden run-off into the Nepean River</td></tr><tr><td>Water Quality</td><td><ul style="list-style-type: none">Water discharged from the site is suitable for receiving waters and capable of supporting existing aquatic ecology and riparian vegetation</td></tr><tr><td>Community</td><td><ul style="list-style-type: none">Ensure public safety</td></tr></table>	Feature	Objective	Stage 8 Area	<ul style="list-style-type: none">Safe (both within the site and in relation to downstream environs, including under flood conditions)Hydraulically, geotechnically and geomorphologically stableNon-pollutingFit for the intended post-Quarrying Operations land use(s)Final landform integrated with surrounding natural landforms as far as is reasonable and feasible, and minimising visual impacts when viewed from surrounding land or the Hume Highway	Surface infrastructure	<ul style="list-style-type: none">Infrastructure within the Hume Motorway road reserve (including the area under the Menangle Bridges) decommissioned and rehabilitated in accordance with TfNSW requirementsAll other surface infrastructure decommissioned and removed, unless otherwise agreed by the Planning Secretary	Quarry Substages	<ul style="list-style-type: none">Pit floor partially backfilled with sufficient and appropriate material to promote establishment of River-Flat Eucalypt Forest EECSubstages progressively landscaped and vegetated to meet the objectives, performance and completion criteria in Table 6 in Appendix 7Batters to be established to a maximum slope of 1:1 (V:H) along the landward edge of each Substage and 1:5 (V:H) adjacent to the Nepean River Buffer Zone	Final Landform	<ul style="list-style-type: none">No reduction in flood storage capacity, compared with pre-development conditions, unless otherwise agreed by the Planning SecretaryDesigned to incorporate geomorphological features to allow for the free draining discharge of clean water from the siteMinimise sediment laden run-off into the Nepean River	Water Quality	<ul style="list-style-type: none">Water discharged from the site is suitable for receiving waters and capable of supporting existing aquatic ecology and riparian vegetation	Community	<ul style="list-style-type: none">Ensure public safety	
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Community	<ul style="list-style-type: none">Ensure public safety																
B71	The Applicant must rehabilitate the Substages progressively, to the	Noted															

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	satisfaction of the Planning Secretary.		
B72	Unless otherwise agreed by the Planning Secretary, the Applicant must ensure that:	Noted – Quarry Operations commenced on 4 September 2023 and the DPE was advised on 9 August 2023 of the commencement See Condition A5 for ongoing notifications	Compliant
	a. no more than two Substages are opened, excavated or worked at any one time without the written approval of the Planning Secretary;		Compliant
	b. the active extraction area in all combined Substages does not exceed 0.33 hectares at any one time;		Compliant
	c. the area of exposed ground at any one time is minimised as far as reasonable and feasible, for the life of the development;		Compliant
	d. Quarrying Operations do not progress from one phase of the development to another unless the progressive rehabilitation performance criteria in the Biodiversity and		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	Rehabilitation Management Plan have been met (with the exception of in the active extraction area) for the previous phase (see condition B73(d) of Schedule 2); and		
	e. the post-extraction batter along the landward edge of each Substage does not exceed a maximum slope of 1:1 (V:H) or the natural underlying sandstone profile.		Compliant
B73	The Applicant must prepare a Biodiversity and Rehabilitation Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:	BRMP and VMP was completed by EMM v3.1 February 2022. It was approved by DPE on 9/3/2022.	Compliant
	a. be prepared by suitably qualified and experienced person/s;		Compliant
	b. be prepared in consultation with BCD and Council;		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	<p>c. describe the short, medium, and long-term measures to be undertaken to:</p> <p>(i) ensure compliance with the biodiversity objectives outlined in Table 6 in Appendix 7;</p> <p>(ii) ensure compliance with the rehabilitation objectives outlined in Table 4 of Schedule 2; and</p> <p>(iii) prevent impacts on aquatic biodiversity, including through the stabilisation of riverbanks and the prevention of sediment-laden runoff;</p>	 <p>Miss Alycia Campbell Environmental Compliance Manager Benedict Recycling Pty Ltd 11 Narabang Way Belrose, NSW, 2085</p> <p>20/07/2021</p> <p>Dear Miss Campbell,</p> <p>Menangle Sand and Soil Quarry (DA85/2865) Combination of Management Plans</p> <p>I refer to your request (DA85/2865-PA-16) to combine the Vegetation Management Plan (VMP) with the Biodiversity and Rehabilitation Management Plan (BRMP), which was submitted in accordance with condition A30 of Schedule 2 of the consent for the Menangle Sand and Soil Quarry (DA85/2865).</p> <p>The Department understands that through the combination of the VMP and BRMP, you are attempting to ensure a consistent approach to vegetation management across the development. The Department has carefully reviewed your request and is satisfied that a clear relationship has been demonstrated between these two plans.</p> <p>Accordingly, the Planning Secretary has approved the combination of the VMP and BRMP.</p> <p>If you wish to discuss the matter further, please contact Callum Firth at callum.firth@dpie.nsw.gov.au.</p> <p>Yours sincerely</p>  <p>Matthew Sprott Director Resource Assessments <i>as nominee of the Planning Secretary</i></p>	Compliant
	d. include detailed progressive rehabilitation performance criteria that must be met for each phase of the development before extraction can progress into subsequent phases;		Compliant BRMP subject to review in 2025 due to flooding



Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	e. include detailed performance and completion criteria for the Restoration Area and the final rehabilitation of the Stage 8 Area (including timeframes for the achievement of the listing criteria of the targeted communities) based on the performance and completion criteria in Table 6 in Appendix 7;		Compliant BRMP subject to review in 2025 due to flooding
	f. include a program to monitor, independently audit and report on progress against the criteria in sub-paragraphs (d) and (e), including reporting in the Annual Review;		Compliant BRMP subject to review in 2025 due to flooding
	g. include an evaluation of the performance of the Restoration Area and the progressive rehabilitation of the Stage 8 Area against the performance and completion criteria required under paragraph (d) above;		Compliant BRMP subject to review in 2025 due to flooding

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	h. include triggers for remedial action (including additional planting or seeding), where the performance or completion criteria required under (d) and (e) above are not met;		Compliant BRMP subject to review in 2025 due to flooding
	i. describe management measures to ensure that Quarrying Operations do not encroach on the Nepean River Buffer Zone and Exclusion Areas;		Compliant
	j. include a detailed description of the measures to be implemented to:		Compliant
	(i) demonstrate compliance with conditions B76 and B78;		Compliant
	(ii) manage the collection and propagation of seed;		Compliant
	(iii) trial methods of extraction of seed resources on site and implement the most effective method of seed recovery;		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	(iv) minimise impacts on tree hollows and termite mounds where reasonable and feasible;		Compliant
	(v) minimise impacts on fauna, including undertaking pre-clearance surveys and supervision (by an appropriately qualified person) of the felling of habitat trees;		Compliant
	(vi) protect native vegetation and fauna habitat outside the approved disturbance area, including in the Restoration Area;		Compliant
	(vii) implement the Stage 8 Area Weed Control Strategy in the Amended Project Summary, except where varied by condition A18 of Schedule 2;		Compliant
	(viii) control feral pests;		Compliant
	(ix) control erosion;		Compliant
	(x) control unrestricted access;		Compliant
	(xi) manage bushfire hazards;		Compliant



Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	(xii) rehabilitate any areas of the Nepean River that are materially harmed by the development (including indirect or incidental impacts); and		Compliant
	(xiii) progressively rehabilitate the site and reasonably and feasibly minimise disturbance areas; and		Compliant BRMP subject to review in 2025 due to flooding
	(xiv) ensure the successful rehabilitation and protection of Stages 6 and 7 until the completion of Quarrying Operations in the Stage 8 Area;		Compliant BRMP subject to review in 2025 due to flooding
	k. include an annual program to monitor and report on: (i) the effectiveness of the measures required under (j) above; (ii) progress against the detailed performance and completion criteria required under (d) and (d) above; (iii) any progressive improvements that could be		Compliant BRMP subject to review in 2025 due to flooding

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	implemented to improve biodiversity outcomes; and (iv) any additional or remedial actions required over the next 12 months;		
	l. identify the potential risks to the successful rehabilitation of the Stage 8 Area, particularly where rehabilitation is damaged or delayed by flooding, and include a detailed description of the contingency measures to be implemented to mitigate against these risks; and		Compliant BRMP subject to review in 2025 due to flooding
	m. include details of who would be responsible for monitoring, reviewing, and implementing the plan.		Compliant
B74	Subject to condition A29, the Applicant must not commence Quarrying Operations in the Stage 8 Area until the Biodiversity and Rehabilitation	Approved by DPE on 09/03/2022. Published on website https://www.benedict.com.au/wp-content/uploads/J190166_26_MSS_BRMP.pdf	Compliant

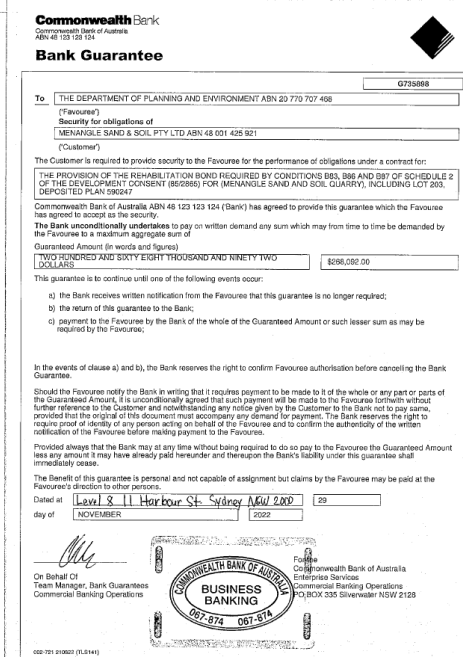
Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	Management Plan is approved by the Planning Secretary.	 <p>Department of Planning and Environment</p> <p>Ms Alycia Campbell 11 NARABANG WAY BELROSE New South Wales 2085</p> <p>09/03/2022</p> <p>Dear Ms Campbell</p> <p>Menangle Quarry (DA 85/2865) Biodiversity and Rehabilitation Management Plan</p> <p>I refer to the Biodiversity and Rehabilitation Management Plan (Revision 3.1 dated 23 February 2022) which was submitted in accordance with condition B73 of the consent (DA 85/2865).</p> <p>The Department has carefully reviewed the document and considers it meets the relevant conditions of consent.</p> <p>Accordingly, I approve the Biodiversity and Rehabilitation Management Plan (Revision 3.1, dated 23 February 2022). Please ensure that the approved plan is placed on the project website at the earliest convenience.</p> <p>If you wish to discuss the matter further, please contact Carl Dumpleton on carl.dumpleton@planning.nsw.gov.au / 9274 6283.</p> <p>Yours sincerely</p>  <p>Jessie Evans Director, Resource Assessments Resource Assessments</p>	
B75	The Applicant must implement the Biodiversity and Rehabilitation Management Plan as approved by the Planning Secretary.	Noted	Compliant
B76	The Applicant must place or create a minimum of 106 nest boxes or tree hollows within the Restoration Area within 12 months of	In the six months of quarry operations 44 had been installed. The remainder to be installed by 4 Sept 2024.	Compliant to date

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	commencing Quarrying Operations in the Stage 8 Area.		
B77	The Applicant must, to the greatest extent practicable, maximise the salvage of resources within the Stage 8 Area, including retention of:	Noted - operational	Compliant
	a. nut and seed resources from native trees; and		Compliant
	b. leaf and small branch material for mulching, for beneficial reuse on the site, including in rehabilitated Substages and in the Restoration Area.		Compliant
B78	Following the conclusion of extraction in each Substage, the Applicant must actively place logs and woody debris salvaged from the approved disturbance area within the completed Substage at the following ratios:	Noted - operational	Compliant – subject to flood impacts
	a. logs and woody debris at least 10 cm in diameter and greater than 0.5 m in length are to be placed in a		Complaint – subject to flood impacts

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	configuration that reflects natural systems, such that there is overall at least 400 m of this woody debris per hectare for all completed Substages; and		
	b. large woody debris at least 50 cm in diameter and greater than 0.5 m in length, such that there is overall at least 100 m of this large woody debris per hectare for all completed Substages.		Complaint subject to flood impacts
B79	The Applicant may undertake timber milling in Stage 8, provided this timber milling occurs outside of the Nepean River Buffer Zone and the Exclusion Areas, and that the Applicant can demonstrate ongoing compliance with condition B78 of this Schedule.	Noted	Not Triggered
B80	The Applicant must rehabilitate 1.22 ha within Stage 6 and 3.44 ha within Stage 7 of the development in accordance with the objectives and the	This has been occurring and has been inhibited by past flooding – Status update for all stages are in Attachment D – Site Rehabilitation Progress Report -	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	performance and completion criteria in Table 6 in Appendix 6.		
B81	By the end of December 2020, or other timing as agreed by the Planning Secretary, the Applicant must submit a Vegetation Management Plan for Stages 6 and 7 to the Planning Secretary for approval. This plan must:	<p>Approval was received from DPE to combine the Vegetation Management Plan with B73 BRMP on 20/7/2022.</p>  <p>Miss Alycia Campbell Environmental Compliance Manager Benedict Recycling Pty Ltd 11 Narabang Way Belrose, NSW, 2085</p> <p>20/07/2021</p> <p>Dear Miss Campbell,</p> <p>Menangle Sand and Soil Quarry (DA85/2865) Combination of Management Plans</p> <p>I refer to your request (DA85/2865-PA-16) to combine the Vegetation Management Plan (VMP) with the Biodiversity and Rehabilitation Management Plan (BRMP), which was submitted in accordance with condition A30 of Schedule 2 of the consent for the Menangle Sand and Soil Quarry (DA85/2865).</p> <p>The Department understands that through the combination of the VMP and BRMP, you are attempting to ensure a consistent approach to vegetation management across the development. The Department has carefully reviewed your request and is satisfied that a clear relationship has been demonstrated between these two plans.</p> <p>Accordingly, the Planning Secretary has approved the combination of the VMP and BRMP.</p> <p>If you wish to discuss the matter further, please contact Callum Firth at callum.firth@dpe.nsw.gov.au.</p> <p>Yours sincerely</p>  <p>Matthew Sprott Director Resource Assessments <i>as nominee of the Planning Secretary</i></p>	Compliant
	a. satisfy the relevant requirements of condition 13 of Schedule 1;		Compliant
	b. clearly define the extent and scope of Stage 6 vegetated lands;		Compliant
	c. clearly define the extent and scope of Stage 7 vegetated lands and identifies that the diversity of species established via retention of current species, tubestock planting or direct seeding is to be raised to deliver the native plant		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	species diversity identified in Table 5 in Appendix 6;		
	d. establish baseline data for the existing habitat in the Stage 6 and 7 areas;		Compliant
	e. describe how the Stage 6 and 7 vegetated lands would be managed and how habitat would be established and retained; and		Compliant
	f. include detailed biodiversity objectives and performance and completion criteria for Stages 6 and 7 of the development, based on the general objectives and performance and completion criteria in Table 5 in Appendix 6, to the satisfaction of the Planning Secretary.		Compliant
B82	The Applicant must implement the Vegetation Management Plan for Stages 6 and 7 to the satisfaction of the Planning Secretary.	Noted	Compliant


Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B83	<p>Within 6 months of the approval of the Biodiversity and Rehabilitation Management Plan, the Applicant must lodge a Rehabilitation Bond with the Department to ensure that rehabilitation of the Stage 8 Area is implemented in accordance with the performance and completion criteria set out in the plan and the relevant conditions in Schedule 2 of this consent. The sum of the bond must be an amount agreed by the Planning Secretary and determined by:</p> <p>a. calculating the cost of rehabilitating all disturbed areas of the site at third party rates (other than land acquisition costs), taking into account the likely surface disturbance over the next 3 years of Quarrying Operations; and</p>	<p>Bond lodged with DPE 29/11/2022 \$268,092</p> 	<p>Compliant</p> <p>Compliant</p>

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	b. employing a suitably qualified, independent and experienced person to verify the calculated costs.		Compliant
B84	The calculation of the Rehabilitation Bond must be submitted to the Department for approval at least 2 months prior to the lodgement of the bond.	Noted	Compliant
B85	The Rehabilitation Bond must be reviewed and if required, an updated bond must be lodged with the Department within 3 months following:	Noted	Compliant
	a. any update or revision to the Biodiversity and Rehabilitation Management Plan;		Not Triggered
	b. the completion of an Independent Environmental Audit in which recommendations relating to the implementation of the Biodiversity and Rehabilitation Management Plan have been made; or		Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	c. in response to a request by the Planning Secretary.		Not Triggered
B86	If rehabilitation is completed generally in accordance with the relevant performance and completion criteria, to the satisfaction of the Planning Secretary, the Planning Secretary will release the bond.	Noted	Not Triggered
B87	If rehabilitation is not completed generally in accordance with the relevant performance and completion criteria, the Planning Secretary will call in all, or part of, the bond, and arrange for the completion of the relevant works.	Noted	Not Triggered
B88	If the Applicant establishes a positive covenant on title under section 88E of the NSW Conveyancing Act 1919 under condition B69, then the Planning Secretary may waive the requirement for all or part of the Rehabilitation Bond required under conditions B83 to B87.	Noted	Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
B89	The Applicant must manage noxious weeds on the site in accordance with the Biodiversity and Rehabilitation Management Plan, and subject to the restrictions in condition A18 of this Schedule, to the satisfaction of the Planning Secretary.	Noted. Weed management occurring onsite – operational and ongoing	Compliant
B90	The Applicant must:	Noted	
	a. take all reasonable steps to minimise the visual and off-site lighting impacts of the development, including potential lighting impacts on the Hume Highway;		Compliant
	b. ensure that the visual appearance of all new structures, facilities or works (including paint colours and specifications) is aimed at blending as far as possible with the surrounding landscape; and		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	c. take all reasonable steps to: <ul style="list-style-type: none"> (i) shield views of Quarrying Operations and associated equipment from users of public roads and at privately-owned residences; and (ii) direct any on-site lighting downwards to avoid lighting impacts on the Hume Highway. 		Compliant
B91	The Applicant must:	Noted	
	a. manage on-site sewage treatment and disposal in accordance with the requirements of an applicable EPL, and to the satisfaction of EPA and Council;		Compliant
	b. minimise the waste generated by the development;		Compliant
	c. ensure that the waste generated by the development is appropriately stored, handled, and disposed of; and		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	d. report on waste minimisation and management in the Annual Review.		Compliant
B92	Except as expressly permitted in an applicable EPL, specific resource recovery order or exemption under the Protection of the Environment Operations (Waste) Regulation 2014, the Applicant must not receive waste at the site for storage, treatment, processing, reprocessing or disposal.	Noted - a log of all material imported in the site is attached below  B91 log of materials imported 2024.pdf	Compliant
B93	The Applicant must ensure that all tanks and similar storage facilities (other than for water) are protected by appropriate bunding or other containment, in accordance with the relevant Australian Standards.	Noted	Compliant
B94	The Applicant must ensure that the storage, handling, and transport of dangerous goods is done in accordance with the latest version of the Australian Standards,	Noted	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	particularly AS 1940-2004 The storage and handling of flammable and combustible liquids (Standards Australia, 2004) and AS/NZS 1596:2014 The storage and handling of LP Gas (Standards Australia, 2014), and the Australian Dangerous Goods Code.		
B95	The Applicant must:	Fire Safety training is conducted for all staff annually as part of the PIRMP process	
	a. ensure that the development: (i) provides for asset protection in accordance with the relevant requirements in the Planning for Bushfire Protection (RFS, 2006) guideline; and (ii) ensure that there is suitable equipment to respond to any fires on the site; and		Compliant
	b. assist the RFS and emergency services to the extent practicable if there is a fire in the vicinity of the site.		Compliant



Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
C1	As soon as practicable and no longer than 7 days after obtaining monitoring results showing an exceedance of any noise or air quality criterion in PART B of Schedule 2 following the date of commencement of Quarrying Operations in the Stage 8 Area, the Applicant must provide details of the exceedance to any affected landowners/tenants if the Applicant has not otherwise reached an agreement to exceed the relevant criteria with the affected landowner pursuant to condition B5 or B12. For any exceedance of any air quality criterion in PART B of this consent, the Applicant must also provide to any affected land owners and tenants a copy of the fact sheet entitled "Mine Dust and You" (NSW Health, 2017).	Noted	Compliant



Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
C2	If, at any time following the date of commencement of Quarrying Operations in the Stage 8 Area, a landowner considers the development to be exceeding any noise or air quality criterion in PART B of Schedule 2, they may ask the Planning Secretary in writing for an independent review of the impacts of the development on their land.	Noted	Not Triggered
C3	If the Planning Secretary is not satisfied that an independent review is warranted, the Planning Secretary will notify the landowner in writing of that decision, and the reasons for that decision, within 21 days of the request for a review.	Noted	Not Triggered
C4	If the Planning Secretary is satisfied that an independent review is warranted, then within 3 months of the Planning Secretary's decision, or as otherwise agreed by the Planning Secretary and the	Noted	Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	landowner, the Applicant must:		
	a. commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Planning Secretary, to: <ul style="list-style-type: none"> (i) consult with the landowner to determine their concerns; (ii) conduct monitoring to determine whether the development is complying with the relevant criteria in PART B of Schedule 2; and (iii) if the development is not complying with that criteria, identify measures that could be implemented to ensure compliance with the relevant criteria; and 		Not Triggered
	b. give the Planning Secretary and landowner a copy of the independent review; and		Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	c. comply with any written requests made by the Planning Secretary to implement any findings of the review.		Not Triggered
D1	An Environmental Management Strategy must be prepared for the development to the satisfaction of the Planning Secretary. This strategy must:	Completed by EMM 25 Feb 2022	Compliant
	a. provide the strategic framework for environmental management of the development;		Compliant
	b. identify the statutory approvals that apply to the development;		Compliant
	c. set out the role, responsibility, authority and accountability of all key personnel involved in the environmental management of the development;		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	d. set out the procedures to be implemented to: <ul style="list-style-type: none"> (i) keep the local community and relevant agencies informed about the operation and environmental performance of the development; (ii) receive record, handle and respond to complaints; (iii) resolve any disputes that may arise during the course of the development; (iv) respond to any non-compliance and any incident; (v) respond to emergencies; and 		Compliant
	e. include: <ul style="list-style-type: none"> (i) references to any strategies, plans and programs approved under the conditions of this consent; and (ii) a clear plan depicting all the monitoring 		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	to be carried out under the conditions of this consent.		
D2	The Applicant must not commence Quarrying Operations in the Stage 8 Area until the Environmental Management Strategy is approved by the Planning Secretary.	<p>Approved by DPE on 23/03/2022. Published on website https://www.benedict.com.au/wp-content/uploads/Environmental-Management-Strategy_V3.pdf</p>  <p>Ms Alycia Campbell Environmental Compliance Manager Benedict Recycling PTY LTD 11 Narbonne Way BELROSE NSW 2085</p> <p>23/03/2022</p> <p>Dear Ms Campbell</p> <p>Menangle Quarry (D4852865) Environment Management Strategy</p> <p>I refer to the Environment Management Strategy which was submitted in accordance with Condition D1 of Schedule 2 of the consent for the Menangle Quarry (D4852865).</p> <p>The Department has carefully reviewed the document and is satisfied that it generally meets the requirements of the conditions.</p> <p>Accordingly, the Secretary has approved the Environment Management Strategy (Revision 3, dated February 2022). Please ensure that the approved plan is placed on the project website at the earliest convenience.</p> <p>If you wish to discuss the matter further, please contact Kevin Reid on (02) 92746206.</p> <p>Yours sincerely</p>  <p>Jessie Evans Director, Resource Assessments Resource Assessments As nominee of the Secretary</p>	Compliant
D3	The Applicant must implement the Environmental Management Strategy as approved by the Planning Secretary.	This was updated to Version 5 and approved by the Secretary	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
		<p>Department of Planning, Housing & Infrastructure</p>  <p>Our ref: DA85/2865-PA-46</p> <p>Ewen McKenzie Acting Environmental Compliance Manager 11 NARABANG WAY BELROSE 2085 13/09/2024</p> <hr/> <p>Subject: Environmental Management Strategy version 5</p> <p>Dear Mr McKenzie</p> <p>I refer to the updated Environmental Management Strategy (version 5) submitted following the 2023 annual environmental review and in response to review comments made by the Department.</p> <p>I have reviewed the plan and consider the minor amendments would still meet the conditions of consent, accordingly I approve the plan.</p> <p>If you wish to discuss the matter further, please contact me via email: carl.dumpleton@planning.nsw.gov.au</p> <p>Yours sincerely</p>  <p>Carl Dumpleton Team Leader – Energy and Resources Assessments As nominee of the Planning Secretary</p>	
D4	<p>Management plans required under this Schedule must be prepared in accordance with relevant guidelines, and include:</p> <p>a. a summary of relevant background or baseline data;</p>	Management Plans are for Substages 8A-8C. When approaching 8D (Phase 3) MSS will need to review and update the Management Plans	<p>Compliant - These were updated in 2024</p> <p>Compliant</p>

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	b. details of: (i) the relevant statutory requirements (including any relevant approval, licence or lease conditions); (ii) any relevant limits or performance measures and criteria; and (iii) the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;		Compliant
	c. a description of the measures to be implemented to comply with the relevant statutory requirements, limits, or performance measures and criteria;		Compliant
	d. a program to monitor and report on the: (i) impacts and environmental performance of the development; and (ii) effectiveness of the		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	management measures set out pursuant to condition D4(c);		
	e. a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;		Compliant
	f. a program to investigate and implement ways to improve the environmental performance of the development over time;		Compliant
	g. a protocol for managing and reporting any: (i) incident, non-compliance or exceedance of the impact assessment criteria or performance criteria; (ii) complaint; or (iii) failure to comply with statutory requirements; and		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	h. a protocol for periodic review of the plan. Note: The Planning Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.		Compliant
D5	Within three months of: a. the submission of an incident report under condition D7; b. the submission of an Annual Review under condition D9; c. the submission of an Independent Environmental Audit under condition D11; d. the approval of any modification to the conditions of this consent; or e. the issue of a direction of the Planning Secretary under condition A8 which requires a review, the suitability of existing strategies, plans and programs required under	Review of the Management Plans will commence post Annual Review (including DPE feedback) and any updated plans will be forwarded to DPE by 31 June 2024	Compliant
			Compliant
			Compliant
			Compliant
			Not Triggered
			Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	this consent must be reviewed by the Applicant.		
D6	If necessary, to either improve the environmental performance of the development, cater for a modification or comply with a direction, the strategies, plans and programs required under this consent must be revised, to the satisfaction of the Planning Secretary and submitted to the Planning Secretary for approval within six weeks of the review.	Noted	Compliant – This occurred in 2024 and will occur in 2025
	Note: This is to ensure strategies, plans and programs are updated on a regular basis and to incorporate any recommended measures to improve the environmental performance of the development.		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
D7	The Applicant must immediately notify the Department and any other relevant agencies immediately after it becomes aware of an incident. The notification must be in writing via the Major Projects Website and identify the development (including the development application number and name) and set out the location and nature of the incident.	Noted	Not Triggered
D8	Within seven days of becoming aware of a non-compliance, the Applicant must notify the Department of the non-compliance. The notification must be in writing via the Major Projects Website and identify the development (including the development application number and name), set out the condition of this consent that the development is non-	Noted	Not Triggered

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	compliant with, the way in which it does not comply and the reasons for the non-compliance (if known) and what actions have been, or will be, undertaken to address the non-compliance.		
	Note: A non-compliance which has been notified as an incident does not need to also be notified as a non-compliance.		
D9	By the end of March in each year after the commencement of Quarrying Operations in the Stage 8 Area, or other timeframe agreed by the Planning Secretary, a report must be submitted to the Department reviewing the environmental performance of the development, to the satisfaction of the Planning Secretary. This review must:	Annual Review report DUE March 31 each year following commencement of quarrying activities (first report was March 31, 2024. Copy to Website and Council D9(g) measures that will be implemented over the next year to improve environmental performance of the development <ul style="list-style-type: none"> - All recommendations provided in the Independent audit will be addressed and completed - A nursery was started onsite during May 2024, it currently contains 600 native plants that are being cared for and grown until matured and ready to use in rehab areas onsite. During 2025 the size of the nursery will be reviewed to increase in size to be able to hold more plants - All management plans will be reviewed within 3 months of submitting the annual review report as per the consent 	Compliant
	a. describe the development (including any rehabilitation) that was		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	carried out in the previous calendar year, and the development that is proposed to be carried out over the current calendar year;	<ul style="list-style-type: none"> - Rehab and weed management onsite will be continued - Nestboxes will be installed as we progress through each substage 	
	b. include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, including a comparison of these results against the: <ul style="list-style-type: none"> (i) relevant statutory requirements, limits or performance measures/criteria; (ii) requirements of any plan or program required under this consent; (iii) monitoring results of previous years; and (iv) relevant predictions in the documents listed condition A7(c). 		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	c. identify any non-compliance or incident which occurred in the previous calendar year, and describe what actions were (or are being) taken to rectify the non-compliance and avoid reoccurrence;		Compliant
	d. evaluate and report on: (i) the effectiveness of the noise and air quality management systems; and (ii) compliance with the performance measures, criteria and operating conditions in this consent, as they relate to the Stage 8 Area;		Compliant
	e. identify any trends in the monitoring data over the life of the development;		Compliant
	f. identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	g. describe what measures will be implemented over the next calendar year to improve the environmental performance of the development.		Compliant
D10	Copies of the Annual Review must be submitted to Council and made available to any interested person upon request.	Noted	Compliant
D11	Within one year of the commencement of Quarrying Operations in the Stage 8 Area, and every three years after, unless the Planning Secretary directs otherwise, the Applicant must commission and pay the full cost of an Independent Environmental Audit of the development. The audit must:	Commission Independent Environmental Audit by 4 September 2024 (submit within 3 months) Next Independent Environmental Audit required every three years 2027, 2030....	Compliant – Ian Swane & Assoc were appointed as well as some additional consultants required by NSW Planning. An extension of time was granted until 28 March 2025
	a. be led and conducted by a suitably qualified, experienced and independent team of experts whose appointment has		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	been endorsed by the Planning Secretary;		
	b. be carried out in consultation with the relevant agencies;		Compliant
	c. assess the environmental performance of the development and whether it is complying with the relevant requirements in this consent, water licences and mining leases for the development (including any assessment, strategy, plan or program required under these approvals);		Compliant
	d. review the adequacy of any approved strategy, plan or program required under the abovementioned approvals and this consent;		Compliant
	e. recommend appropriate measures or actions to improve the environmental performance of the development and any assessment, strategy, plan or program required under the		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	abovementioned approvals and this consent; and		
	f. be conducted and reported to the satisfaction of the Planning Secretary.		Compliant
D12	Within three months of commencing an Independent Environmental Audit, or within another timeframe agreed by the Planning Secretary, the Applicant must submit a copy of the audit report to the Planning Secretary, and any other NSW agency that requests it, together with its response to any recommendations contained in the audit report, and a timetable for the implementation of the recommendations. The recommendations must be implemented to the satisfaction of the Planning Secretary.	Noted	Compliant
	Note: The audit team must be led by a suitably qualified		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	auditor and include experts in any fields specified by the Planning Secretary.		
D13	Any condition of this consent that requires the carrying out of monitoring or an environmental audit, whether directly or by way of a plan, strategy or program, is taken to be a condition requiring monitoring or an environmental audit under Division 9.4 of Part 9 of the EP&A Act. This includes conditions in respect of incident notification, reporting and response, non-compliance notification, compliance report and independent audit.	Noted	Compliant
	Note: For the purposes of this condition, as set out in the EP&A Act, “monitoring” is monitoring of the development to provide data on compliance with the consent or on the environmental impact of the development, and an “environmental audit” is a		Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	periodic or particular documented evaluation of the development to provide information on compliance with the consent or the environmental management or impact of the development.		
D14	Noise and air quality monitoring under Part B of this Schedule is not required at all privately-owned residences and the use of representative monitoring locations can be used to demonstrate compliance with criteria.	Noted	Compliant
D15	Prior to commencing Quarrying Operations in the Stage 8 Area, the Applicant must:		
	a. make the following information and documents (as they are obtained, approved or as otherwise stipulated within the conditions of this consent) publicly available on its website:		

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	(i) the document/s listed in condition A7(c);	Completed	Compliant
	(ii) all current statutory approvals for the development;	Completed	Compliant
	(iii) all approved strategies, plans and programs required under the conditions of this consent;	Completed	Compliant
	(iv) regular reporting on the environmental performance of the development in accordance with the reporting requirements in any plans or programs approved under the conditions of this consent;	Copy of the 2023 Annual Review online	Compliant
	(v) a comprehensive summary of the monitoring results of the development, reported in accordance with the specifications in any conditions of this consent, or any approved plans and programs;	Copy of the 2023 Annual Review online	Compliant
	(vi) a summary of the current stage and progress of the development;	Copy of the 2023 Annual Review online	Compliant

Condition	Requirement	Tracking	Compliant Y/N Triggered Y/N
	(vii) contact details to enquire about the development or to make a complaint;	Completed - also a sign at the front gate	Compliant
	(viii) a complaints register, updated monthly;	Completed	Compliant
	(ix) the Annual Reviews of the development;	Noted and being prepared for 2024	Compliant
	(x) audit reports prepared as part of any Independent Environmental Audit of the development and the Applicant's response to the recommendations in any audit report;	Completed	Compliant
	(xi) any other matter required by the Planning Secretary; and	Noted	Compliant
	b. keep such information up to date for the life of the development and to the satisfaction of the Planning Secretary.	Noted	Compliant

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Appendix 4 Noise Compliance Assessment

Applicable Meteorological Conditions

1. The noise criteria in condition B4 of Schedule 2 are to apply under all meteorological conditions except the following:
 - (a) where 3°C/100 metres (m) lapse rates have been assessed, then:
 - (i) wind speeds greater than 3 metres/second (m/s) measured at 10m above ground level;
 - (ii) temperature inversion conditions between 1.5°C and 3°C/100m and wind speeds greater than 2m/s measured at 10m above ground level; or
 - (iii) temperature inversion conditions greater than 3°C/100m.
 - (b) where Pasquill Stability Classes have been assessed, then:
 - (i) wind speeds greater than 3m/s at 10m above ground level;
 - (ii) stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or
 - (iii) stability category G temperature inversion conditions.

Determination of Meteorological Conditions

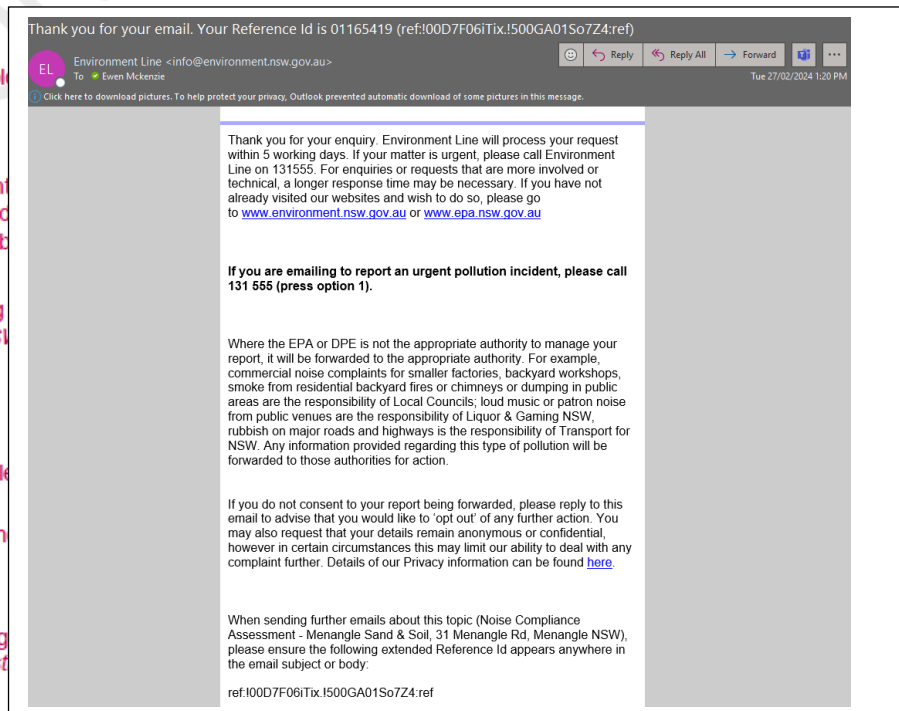
2. Except for wind speed at microphone height, the data to be used for determining meteorological conditions is that recorded by the meteorological station required under condition B17 of Schedule 2.

Compliance Monitoring

3. A noise compliance assessment must be undertaken within two months of commencement in the Stage 8 Area. The assessment must be conducted by a suitably qualified and experienced practitioner and must assess compliance with the noise criteria in condition B4 of Schedule 2. A report must be submitted to the Planning Secretary within 1 month of the assessment.
4. Unless otherwise agreed by the Planning Secretary, attended compliance monitoring must be undertaken in accordance with the relevant requirements for reviewing performance set out in the *NSW Noise Policy for Industry* (EPA, 2000), in particular the requirements relating to:
 - (c) monitoring locations for the collection of representative noise data;
 - (d) meteorological conditions during which collection of noise data is not appropriate;
 - (e) equipment used to collect noise data, and conformity with Australian Standards relevant to the equipment used;
 - (f) modifications to noise data collected, including for the exclusion of extraneous noise and modifying factors apart from adjustments for duration,
 - (g) modifying factors apart from adjustments for duration,

with the exception of applying appropriate modifying factors for low frequency noise during which compliance monitoring should be undertaken in accordance with Fact Sheet C of the *NSW Noise Policy for Industry*.

Submitted to EPA 27/2/24



CONSOLIDATED CONSENT**Appendix 6 Additional Stage 6 and 7 Biodiversity and Rehabilitation Requirements**

Table 5: Additional Biodiversity Objectives and Performance and Completion Criteria for Stage 6 and 7 Vegetated Areas

Rehabilitation Objective	Performance Indicator	Completion Criteria	Example Justification/validation methods	Performance Guidance
Composition Objective				
The vegetation composition of Stages 6 and 7 are recognisable as River-flat Eucalypt Forest EEC.	Native plant species are characteristic of River-flat Eucalypt Forest EEC as described in the Final Determination. <i>HN526 benchmark for native plant species richness is ≥ 24 species.</i> <i>It is noted that Eucalyptus botryoides x saligna is not listed in the River-flat Eucalypt Forest EEC Final Determination, but is to count as one species towards the benchmark value.</i>	Presence of a suitable number or proportion of species listed in the Final Determination. This is considered to be ≥ 24 species, across all monitoring plots, that are aligned with the species list in the Final Determination.	Use of standard 20 x 20 m floristic sampling plot(s) where all flora species present are recorded.	This criterion should be met early (i.e. at 5 years post-establishment), otherwise it is unlikely to be met in the long-term.
Structure Objectives				
The vegetation structure of Stages 6 and 7 are recognisable as, or is trending towards, the target BVT HN526, which provides a suitable surrogate for River-flat Eucalypt Forest EEC	Cover and abundance of plant growth forms are characteristic of, or are trending towards, the target BVT benchmarks, which are provided in the completion criteria.	Total foliage cover of species allocated to Tree (TG) growth form is trending towards the benchmark range of 27.5– 32.5	Use of BAM where all flora species present in a 20 x 20 m plot are recorded, with foliage cover and abundance of each species.	Foliage cover of Tree (TG) growth form is trending towards target value.
		Total foliage cover of species allocated to Shrub (SG) growth form is trending towards the benchmark range of 21-31		Foliage cover of Shrub (SG) growth form is trending towards target value.

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Rehabilitation Objective	Performance Indicator	Completion Criteria	Example Justification/validation methods	Performance Guidance
		Total foliage cover of species allocated to Grass and Grass-like (GG) growth form is trending towards the benchmark range of 24.45-30.45		Foliage cover of Grass and Grass-like (GG) growth form is trending towards target value.
		Total foliage cover of species allocated to Forb (FG) growth form is trending towards the benchmark range of 24.45-30.45		Foliage cover of Forb (FG) growth form is trending towards target value.
Function Objectives				
Levels of ecosystem function have been established that demonstrate that Stages 6 and 7 are self-sustainable, or is trending towards self-sustainability	Evidence of plant reproduction and regeneration is present	The cover and species richness of the groundcover, including grasses and forbs, is stable or increasing, and is within the benchmark ranges	The ongoing persistence of groundcover species, which are relatively short lived and for which recruitment is not straightforward to measure, is regarded as evidence of reproduction and regeneration of these species	An initial decline in species richness and cover may occur, however a stabilisation in observed cover and richness should be observed by 5 to 10 years post-establishment.
		Second generation individuals of shrubs and trees are present	Presence of second-generation canopy species is evident within the rehabilitation domain (i.e. not limited to the plot, but present within rehabilitation of the same target community and age).	No performance guidance. The presence of second-generation trees and shrubs may not be evident for many years post-establishment.

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Rehabilitation Objective	Performance Indicator	Completion Criteria	Example Justification/validation methods	Performance Guidance
	Cover of exotic species is low	Cover of 'high threat exotic' (HTE) and 'priority weeds' is no more than 2%.	Data collected in accordance with BAM. Sum foliage cover of species identified as 'high threat exotic' under the BAM and 'priority weeds' as identified by the Local Land Services (LLS) in the relevant strategic weed management plan for the region.	Cover of HTE and priority weed species are declining towards target value. Given the very high weed loads it is expected that it will take some time for weed growth to be brought under control and will require ongoing maintenance.
	Indicators of nutrient cycling are suitable for sustaining the target plant community type	Litter cover is within the benchmark range. There is no biometric benchmark, and thus the BAM benchmark of 40 for PCT835 is adopted	Data collected in accordance with BAM via five 1 m ² subplots within the 20 m ² floristic plot	Litter cover is increasing towards target value.
<p>Notes:</p> <p>Achieving biometric vegetation type (BVT) HN526 and/or plant community type (PCT) in the NSW Bionet Vegetation Information System (PCT835), can be used as a suitable surrogate for the EEC. BVT benchmarks are more specific (to vegetation type level, usually with lower and upper thresholds), whereas PCT benchmarks are to a broader vegetation class level (which is a grouping of similar vegetation types). For this reason, BVT benchmarks have generally been utilised in this table as being the best available.</p> <p>The Completion Criteria column refers to the desired end goal, with the Performance Guidance column providing broad guidance on how the completion criteria should be interpreted in terms of producing future performance criteria in relevant Vegetation Management Plan(s). It is noted that the completion criteria and performance indicators in Table 5 will need to be resolved with more specific performance criteria relevant to different areas of the site.</p> <p>It is also noted that stochastic events such as flood or fire might affect the achievement of performance standards and criteria, and whilst the intent will still be to achieve restoration and rehabilitation of the River-flat Eucalypt Forest EEC in the long-term, such events will need to be taken into account on a case by case basis for specific performance standards.</p>				

CONSOLIDATED CONSENT**Appendix 7 Stage 8 Operations Biodiversity and Rehabilitation**

Table 6: Biodiversity Objectives and Performance and Completion Criteria

Rehabilitation Objective	Performance Indicator	Completion Criteria	Example Justification/validation methods	Performance Guidance
Composition Objective				
The vegetation composition of the Restoration Area and rehabilitated substages are recognisable as River-flat Eucalypt Forest EEC.	<p>Native plant species are characteristic of River-flat Eucalypt Forest EEC as described in the Final Determination.</p> <p><i>HN526 benchmark for native plant species richness is ≥ 24 species.</i></p> <p><i>It is noted that Eucalyptus botryoides x saligna is not listed in the River-flat Eucalypt Forest EEC Final Determination, but is to count as one species towards the benchmark value.</i></p>	<p>Presence of a suitable number or proportion of species listed in the Final Determination.</p> <p>This is considered to be ≥ 24 species, across all monitoring plots, that are aligned with the species list in the Final Determination.</p>	Use of standard 20 x 20 m floristic sampling plot(s) where all flora species present are recorded.	This criterion should be met early (i.e. at 5 years post-establishment), otherwise it is unlikely to be met in the long-term.
Structure Objectives				
The vegetation structure of the Restoration Area and rehabilitated substages are recognisable as, or is trending towards, the target BVT HN526, which provides a suitable surrogate for River-flat Eucalypt Forest EEC	Cover and abundance of plant growth forms are characteristic of, or are trending towards, the target BVT benchmarks, which are provided in the completion criteria.	Total foliage cover of species allocated to Tree (TG) growth form is trending towards the benchmark range of 27.5– 32.5	Use of BAM where all flora species present in a 20 x 20 m plot are recorded, with foliage cover and abundance of each species.	Foliage cover of Tree (TG) growth form is trending towards target value.
		Total foliage cover of species allocated to Shrub (SG) growth form is trending towards the benchmark range of 21-31		Foliage cover of Shrub (SG) growth form is trending towards target value.

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Rehabilitation Objective	Performance Indicator	Completion Criteria	Example Justification/validation methods	Performance Guidance
		Total foliage cover of species allocated to Grass and Grass-like (GG) growth form is trending towards the benchmark range of 24.45 - 30.45		Foliage cover of Grass and Grass-like (GG) growth form is trending towards target value.
		Total foliage cover of species allocated to Forb (FG) growth form is trending towards the benchmark range of 24.45 - 30.45		Foliage cover of Forb (FG) growth form is trending towards target value.
Function Objectives				
Levels of ecosystem function have been established that demonstrate the Restoration Area and rehabilitated substages are self-sustainable, or is trending towards self-sustainability	Evidence of plant reproduction and regeneration is present	The cover and species richness of the groundcover, including grasses and forbs, is stable or increasing, and is within the benchmark ranges	The ongoing persistence of groundcover species, which are relatively short lived and for which recruitment is not straightforward to measure, is regarded as evidence of reproduction and regeneration of these species	An initial decline in species richness and cover may occur, however a stabilisation in observed cover and richness should be observed by 5 to 10 years post-establishment.
		Second generation individuals of shrubs and trees are present	Presence of second-generation canopy species is evident within the rehabilitation domain (i.e. not limited to the plot, but present within rehabilitation of the same target community and age).	No performance guidance. The presence of second-generation trees and shrubs may not be evident for many years post-establishment.

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Rehabilitation Objective	Performance Indicator	Completion Criteria	Example Justification/validation methods	Performance Guidance
	Cover of exotic species is low	Cover of 'high threat exotic' (HTE) and 'priority weeds' is no more than 2%.	Data collected in accordance with BAM. Sum foliage cover of species identified as 'high threat exotic' under the BAM and 'priority weeds' as identified by the Local Land Services (LLS) in the relevant strategic weed management plan for the region.	Cover of HTE and priority weed species are declining towards target value. Given the very high weed loads it is expected that it will take some time for weed growth to be brought under control and will require ongoing maintenance.
	Indicators of nutrient cycling are suitable for sustaining the target plant community type	Litter cover is within the benchmark range. There is no biometric benchmark, and thus the BAM benchmark of 40 for PCT835 is adopted	Data collected in accordance with BAM via five 1 m ² subplots within the 20 m ² floristic plot	Litter cover is increasing towards target value.
<p>Notes:</p> <p>Achieving biometric vegetation type (BVT) HN526 and/or plant community type (PCT) in the NSW Bionet Vegetation Information System (PCT835), can be used as a suitable surrogate for the EEC. BVT benchmarks are more specific (to vegetation type level, usually with lower and upper thresholds), whereas PCT benchmarks are to a broader vegetation class level (which is a grouping of similar vegetation types). For this reason, BVT benchmarks have generally been utilised in this table as being the best available.</p> <p>The Completion Criteria column refers to the desired end goal, with the Performance Guidance column providing broad guidance on how the completion criteria should be interpreted in terms of producing future performance criteria within the Biodiversity and Rehabilitation Management Plan required under condition B73 of Schedule 2 of this consent. It is noted that the completion criteria and performance indicators in Table 6 will need to be resolved with more specific performance criteria relevant to different areas of the site. For example, the Amended restoration area will contain a tree overstorey and thus the performance standard should be higher compared to the Amended extraction area where some time will be required for the tree overstorey cover to become established. Refined performance criteria are to be included in the Biodiversity and Rehabilitation Management Plan.</p> <p>It is also noted that stochastic events such as flood or fire might affect the achievement of performance standards and criteria, and whilst the intent will still be to achieve restoration and rehabilitation of the River-flat Eucalypt Forest EEC in the long-term, such events will need to be taken into account on a case by case basis for specific performance standards.</p>				

Appendix 8 Incident Notification and Reporting Requirements

WRITTEN INCIDENT NOTIFICATION REQUIREMENTS

1. A written incident notification addressing the requirements set out below must be submitted to the Department via the Major Projects website within seven days after the Applicant becomes aware of an incident. Notification is required to be given under this condition even if the Applicant fails to give the notification required under condition D7 of Schedule 2 or, having given such notification, subsequently forms the view that an incident has not occurred.
2. Written notification of an incident must:
 - a. identify the development and application number;
 - b. provide details of the incident (date, time, location, a brief description of what occurred and why it is classified as an incident);
 - c. identify how the incident was detected;
 - d. identify when the applicant became aware of the incident;
 - e. identify any actual or potential non-compliance with conditions of consent;
 - f. describe what immediate steps were taken in relation to the incident;
 - g. identify further action(s) that will be taken in relation to the incident; and
 - h. identify a project contact for further communication regarding the incident.
3. Within 30 days of the date on which the incident occurred or as otherwise agreed to by the Planning Secretary, the Applicant must provide the Planning Secretary and any relevant public authorities (as determined by the Planning Secretary) with a detailed report on the incident addressing all requirements below, and such further reports as may be requested.
4. The Incident Report must include:
 - a. a summary of the incident;
 - b. outcomes of an incident investigation, including identification of the cause of the incident;
 - c. details of the corrective and preventative actions that have been, or will be, implemented to address the incident and prevent recurrence; and
 - d. details of any communication with other stakeholders regarding the incident.

Menangle Sand and Soil Quarry

Noise Compliance Q1 Assessment

Prepared for Menangle Sand and Soil Pty Ltd

March 2024

Menangle Sand and Soil Quarry

Noise Compliance Q1 Assessment

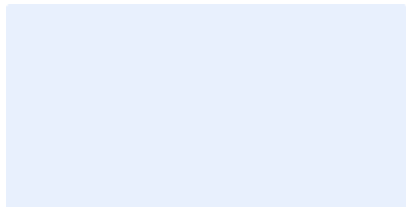
Menangle Sand and Soil Pty Ltd

E240224 RP1

March 2024

Version	Date	Prepared by	Reviewed by	Comments
1	12 March 2024	Jared Blackburn	Najah Ishac	

Approved by



Najah Ishac

Director, Technical leader Acoustics

12 March 2024

Ground floor 20 Chandos Street

St Leonards NSW 2065

PO Box 21

St Leonards NSW 1590

This report has been prepared in accordance with the brief provided by Menangle Sand and Soil Pty Ltd and, in its preparation, EMM has relied upon the information collected at the times and under the conditions specified in this report. All findings, conclusions or recommendations contained in this report are based on those aforementioned circumstances. The contents of this report are private and confidential. This report is only for Menangle Sand and Soil Pty Ltd's use in accordance with its agreement with EMM and is not to be relied on by or made available to any other party without EMM's prior written consent. Except as permitted by the *Copyright Act 1968* (Cth) and only to the extent incapable of exclusion, any other use (including use or reproduction of this report for resale or other commercial purposes) is prohibited without EMM's prior written consent. Except where expressly agreed to by EMM in writing, and to the extent permitted by law, EMM will have no liability (and assumes no duty of care) to any person in relation to this document, other than to Menangle Sand and Soil Pty Ltd (and subject to the terms of EMM's agreement with Menangle Sand and Soil Pty Ltd).

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1 Introduction

1.1 Background

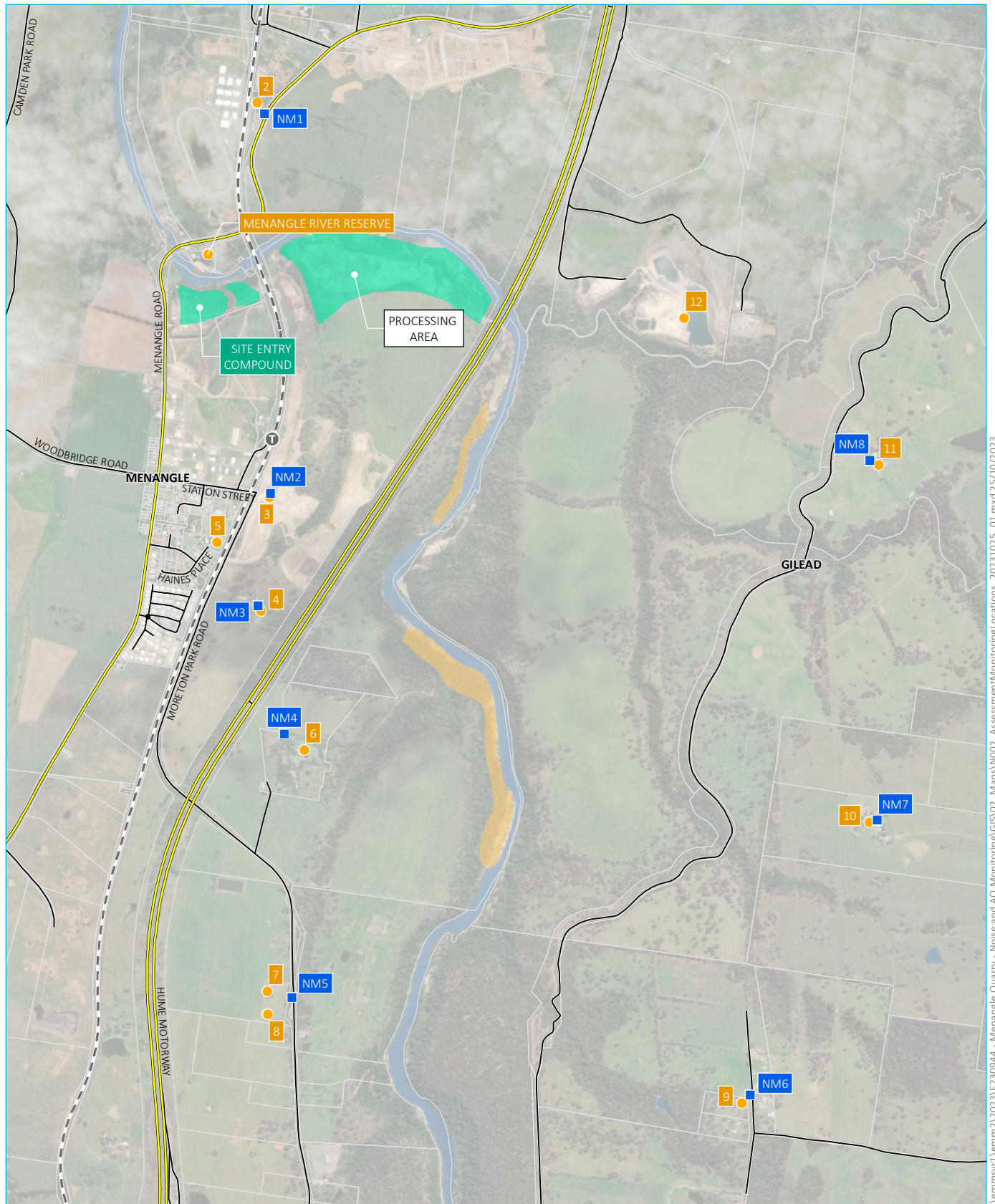
EMM Consulting Pty Ltd (EMM) was engaged by Menangle Sand and Soil Pty Ltd to conduct a noise survey of operations at Menangle Sand and Soil (the site) located at 15 Menangle Road, Menangle NSW. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified limits within the noise management plan. It is a requirement of the development consent LEC 2018/342158 for regular attended noise monitoring to be carried out every three months. Attended environmental noise monitoring described in this report was done during the shoulder and day periods of 28 February 2024 at five monitoring locations.

1.2 Assessment locations

The assessment locations are detailed in Table 1.1 and shown on Figure 1.1. It should be noted that Figure 1.1 shows actual monitoring positions, not necessarily the location of residences. The locations in bold in Table 1.1 were the adopted monitoring locations.

Table 1.1 **Attended noise monitoring locations**

ID	Representative residences	Description	Coordinates (MGA56)	
			Easting	Northing
NM1	R2	Menangle Road North	291937	6223124
NM2	R3, R5	Station Street North	291964	6221374
NM3	R4	Station Street East	291907	6220855
NM4	R6	Morton Park Road North	292028	6220262
NM5	R7, R8	Morton Park Road South	292064	6219045
NM6	R9	Bulli Appin Road South	294179	6218595
NM7	R10	Bulli Appin Road North	294766	6219863
NM8	R11	Appin Road	294732	6221523



Source: EMM (2020); DFSI (2017); GA (2011)

KEY

- | | |
|---|---|
| ■ Monitoring location | Cadastral boundary |
| ● Assessment location | Extractive operations |
| T Train station | Stage 8 |
| — Rail line | |
| — Main road | |
| — Local road | |
| — Nepean River | |

Site boundary, sensitive receivers
and noise monitoring locations

Menangle Sand and Soil Quarry
Environmental Noise Monitoring
Figure 1.1

1.3 Terminology and abbreviations

Some definitions of terms and abbreviations which may be used in this report are provided in Table 1.2.

Table 1.2 Terminology and abbreviations

Term/descriptor	Definition
dB(A)	Noise level measurement units are decibels (dB). The “A” weighting scale is used to approximate how humans hear noise.
L_{Amax}	The maximum root mean squared A-weighted noise level over a time period.
L_{A1}	The A-weighted noise level which is exceeded for 1% of the time.
$L_{A1,1minute}$	The A-weighted noise level which is exceeded for 1% of the specified time period of 1 minute.
L_{A10}	The A-weighted noise level which is exceeded for 10% of the time.
L_{Aeq}	The energy average A-weighted noise level.
L_{A50}	The A-weighted noise level which is exceeded for 50% of the time, also the median noise level during a measurement period.
L_{A90}	The A-weighted noise level exceeded for 90% of the time, also referred to as the “background” noise level and commonly used to derive noise limits.
L_{Amin}	The minimum A-weighted noise level over a time period.
L_{Ceq}	The energy average C-weighted noise energy during a measurement period. The “C” weighting scale is used to take into account low-frequency components of noise within the audibility range of humans.
SPL	Sound pressure level. Fluctuations in pressure measured as 10 times a logarithmic scale, with the reference pressure being 20 micropascals.
Hertz (Hz)	The frequency of fluctuations in pressure, measured in cycles per second. Most sounds are a combination of many frequencies together.
AWS	Automatic weather station used to collect meteorological data, typically at an altitude of 10 metres
VTG	Vertical temperature gradient in degrees Celsius per 100 metres altitude.
Sigma-theta	The standard deviation of the horizontal wind direction over a period of time.
IA	Inaudible. When site noise is noted as IA then there was no site noise at the monitoring location.
NM	Not Measurable. If site noise is noted as NM, this means some noise was audible but could not be quantified.
Day	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.

Appendix A provides further information that gives an indication as to how an average person perceives changes in noise level, and examples of common noise levels.

2 Noise limits

2.1 Development consent

LEC 2018/342158 B6 states that:

The applicant must carry out regular attended noise monitoring (every three months unless otherwise agreed with the planning secretary) to determine whether the development is complying with the relevant conditions of Schedule 2.

Relevant sections of the development consent are reproduced in Appendix B.2.

2.2 Noise management plan

Noise monitoring requirements are detailed in the site's Noise Management Plan (NMP), most recently approved in February 2022.

Noise criteria for the facility are stipulated in Table 2 of development consent Condition B4 and section 5 of the NMP. The noise criteria are specified for the day and shoulder periods and apply at all residential receivers which have the potential to be impacted by operational noise from the quarry (refer to Figure 1.1 for the nearest residential receivers).

Relevant sections of the NMP are reproduced in Appendix B.1.

2.3 Environmental Protection Licence

The site's Environmental Protection Licence (EPL, 3991), version date 13 December 2023 does not contain any noise limits.

2.4 Noise limit summary

Noise impact limits based on the approved NMP and LEC are provided in Table 2.1.

Table 2.1 Noise impact limits, dB

Location	Day $L_{Aeq,15minute}$	Shoulder $L_{Aeq,15minute}$	Shoulder L_{Amax}
NM1	45	45	55
NM2	45	45	55
NM3	54	52	62
NM4	45	45	55
NM5	45	45	55
NM6	45	45	55
NM7	35	35	45
NM8	35	35	45

Notes:

1. Day period is between 7 am–6 pm Monday to Saturday and 8 am–6 pm Sundays and Public Holidays.
2. Shoulder period is between 6 am–7 am Monday to Saturday.

2.5 Meteorological conditions

The meteorological conditions will be used to determine if the noise criteria (refer to Table 2.1) apply in accordance with the INP. Condition 1 of Appendix 4 of the development consent states that:

The noise criteria in condition B4 of Schedule 2 are to apply under all meteorological conditions except the following:

(a) where $3^{\circ}\text{C}/100$ metres (m) lapse rates have been assessed, then:

- (i) wind speeds greater than 3 metres/second (m/s) measured at 10m above ground level;
- (ii) temperature inversion conditions between 1.5°C and $3^{\circ}\text{C}/100\text{m}$ and wind speeds greater than 2m/s measured at 10m above ground level; or
- (iii) temperature inversion conditions greater than $3^{\circ}\text{C}/100\text{m}$.

(b) where Pasquill Stability Classes have been assessed, then:

- (i) wind speeds greater than 3m/s at 10m above ground level;
- (ii) stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or
- (iii) stability category G temperature inversion conditions.

2.6 Additional considerations

Monitoring and reporting have been done in accordance with the NSW EPA 'Noise Policy for Industry' (NPfI) issued in October 2017 and the 'Approved methods for the measurement and analysis of environmental noise in NSW' (Approved Methods) issued in January 2022.

3 Methodology

3.1 Overview

Attended environmental noise monitoring was done in general accordance with Australian Standard AS1055 'Acoustics, Description and Measurement of Environmental Noise' and relevant NSW government requirements. Meteorological data was obtained from the site automatic weather station (AWS) which allowed correlation of atmospheric parameters with measured site noise levels.

3.2 Attended noise monitoring

During this survey, attended noise monitoring was conducted at NM4 during the shoulder period and NM1, NM2, NM3, NM4 and NM5 in the day period. These locations were selected as they are the worst affected noise monitoring locations from the pool detailed in the NMP. Due to meteorological and operational conditions on the day of monitoring, NM6, NM7 and NM8 would experience lesser noise levels than the locations selected. The duration of each measurement was 15 minutes. Atmospheric conditions were measured during noise surveys at each monitoring location.

Measured sound levels from various sources were noted during each measurement and particular attention was paid to the extent of site's contribution (if any) to measured levels. At each monitoring location, the site-only $L_{Aeq,15\text{minute}}$ and L_{Amax} were measured directly or determined by other methods detailed in Section 7.1 of the NPfI.

The terms 'Inaudible' (IA) or 'Not Measurable' (NM) may be used in this report. When site noise is noted as IA, it was inaudible at the monitoring location. When site noise is noted as NM, this means it was audible but could not be quantified. All results noted as IA or NM in this report were due to one or more of the following:

- Site noise levels were very low, typically more than 10 dB below the measured background (L_{A90}), and unlikely to be noticed.
- Site noise levels were masked by more dominant sources that are characteristic of the environment (such as breeze in foliage or continuous road traffic noise) that cannot be eliminated by monitoring at an alternate or intermediate location.
- It was not feasible or reasonable to employ methods, such as to move closer and back calculate. Cases may include rough terrain preventing closer measurement, addition/removal of significant source to receiver shielding caused by moving closer, and meteorological conditions where back calculation may not be accurate.

If exact noise levels from site could not be established due to masking by other noise sources in a similar frequency range but were determined to be at least 5 dB lower than relevant limits, then a maximum estimate of site may be provided. This is expressed as a 'less than' quantity, such as <20 dB or <30 dB.

3.3 Modifying factors

All measurements were evaluated for potential modifying factors in accordance with the NPfI. Assessment of modifying factors is undertaken at the time of measurement if the site was audible and directly quantifiable. If applicable, modifying factor penalties have been reported and added to measured site-only L_{Aeq} .

Low-frequency modifying factor penalties have only been applied to site-only L_{Aeq} levels if the site was the only contributing low-frequency noise source. Specific methodology for assessment of each modifying factor is outlined in Fact Sheet C of the NPfl.

3.4 Instrumentation and personnel

Attended noise monitoring was conducted by Jared Blackburn. Qualifications, experience, and competence is in accordance with the Approved methods and supportive documentation is available upon request.

Equipment used to measure environmental noise levels is detailed in Table 3.1. Calibration certificates are provided in Appendix C.

Table 3.1 **Measurement equipment**

Item	Serial number	Calibration due date	Relevant standard
Brüel & Kjær Type 2250 sound level meter	3008201	12 July 2025	IEC 61672-1:2002
Svantek V36 calibrator	138019	01 August 2024	IEC 60942:2003

4 Results

4.1 Total measured noise levels and atmospheric conditions

Total noise levels measured during each 15-minute attended measurement are provided in Table 4.1.

Table 4.1 Total measured noise levels, dB – February 2024 ¹

Location	Start date and time	L _{Amax}	L _{A1}	L _{A10}	L _{Aeq}	L _{A50}	L _{A90}	L _{Amin}
NM4 ³	28/02/2024 6:36	63	57	56	54	54	51	49
NM4 ³	28/02/2024 7:00	67	58	56	53	53	49	47
NM3 ²	28/02/2024 7:20	76	72	59	59	55	52	49
NM2 ²	28/02/2024 7:41	65	56	52	50	49	47	45
NM1 ³	28/02/2024 8:04	84	76	73	70	68	57	45
NM5 ³	28/02/2024 8:27	85	67	49	58	42	40	38

Notes: 1. Levels in this table are not necessarily the result of activity at site.
 2. Non site constant construction and traffic noise was present during measurement
 3. Constant non site traffic noise was present during measurement

Atmospheric condition data measured by the operator during each measurement using a hand-held weather meter is shown in Table 4.2. The wind speed, direction and temperature were measured at approximately 1.5 metres above ground. Attended noise monitoring is not done during rain, hail, or wind speeds above 5 m/s at microphone height. This data was collected over a short duration of typically 5 minutes, however atmospheric conditions were observed to be relatively constant during the 15 minute measurement.

Table 4.2 Measured (hand held meter) atmospheric conditions – February 2024

Location	Start date and time	Temperature °C	Wind speed m/s	Wind direction ° magnetic north ¹	Cloud cover 1/8s
NM4	28/02/2024 6:36	19	<0.5	-	8
NM4	28/02/2024 7:00	20	<0.5	-	8
NM3	28/02/2024 7:20	20	<0.5	-	8
NM2	28/02/2024 7:41	21	<0.5	-	8
NM1	28/02/2024 8:04	22	<0.5	-	8
NM5	28/02/2024 8:27	22	<0.5	-	8

Notes: 1. "-" indicates calm conditions at monitoring location.

4.2 Site only noise levels

4.2.1 Modifying factors

There were no modifying factors, as defined in the NPfI, applicable during the survey.

4.2.2 Monitoring results

Table 4.3 provides site noise levels in the absence of other sources, where possible, and includes weather data from the site AWS. Limits are applicable if weather conditions were within specified parameters during each measurement. The data shows that site was inaudible at all locations and confirms compliance with the site's consent conditions.

Table 4.3 Site noise levels and limits – February 2024

Location	Start date and time	Wind		Stability class	Limits apply? ¹	Limits, dB		Site levels, dB		Exceedances, dB ¹	
		Speed m/s	Direction ³			L _{Aeq,15minute}	L _{Amax}	L _{Aeq,15minute} ²	L _{Amax}	L _{Aeq,15minute}	L _{Amax}
NM4	28/02/2024 6:36	0.2	209	A	Y	45	55	IA	IA	Nil	Nil
NM4	28/02/2024 7:00	-	-	A	Y	45	N/A	IA	N/A	Nil	N/A
NM3	28/02/2024 7:20	0.2	325	A	Y	54	N/A	IA	N/A	Nil	N/A
NM2	28/02/2024 7:41	0.2	350	A	Y	45	N/A	IA	N/A	Nil	N/A
NM1	28/02/2024 8:04	0.7	345	A	Y	45	N/A	IA	N/A	Nil	N/A
NM5	28/02/2024 8:27	1.1	98	A	Y	45	N/A	IA	N/A	Nil	N/A

- Notes:
1. Noise emission limits are applicable if weather conditions were within parameters specified in Section 2.4. NA in exceedance column indicates that limits were not applicable due to weather conditions.
 2. Site-only L_{Aeq,15minute}, includes modifying factor penalties if applicable.
 3. Degrees magnetic north, “-” indicates calm conditions.

5 Summary

EMM was engaged by Menangle Sand and Soil Pty Ltd to conduct a noise survey of operations at the site. The survey purpose was to quantify the acoustic environment and compare site noise levels against specified noise limits in the approved NMP.

Attended environmental noise monitoring described in this report was done during the shoulder or day period(s) of 28 February 2024 at five monitoring locations.

Noise levels from site complied with all relevant limits and consent noise conditions.

Appendix A

Noise perception and examples

A.1 Noise levels

Table A.1 gives an indication as to how an average person perceives changes in noise level. Examples of common noise levels are provided in Figure A.1.

Table A.1 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise
up to 2	Not perceptible
3	Just perceptible
5	Noticeable difference
10	Twice (or half) as loud
15	Large change
20	Four times (or quarter) as loud

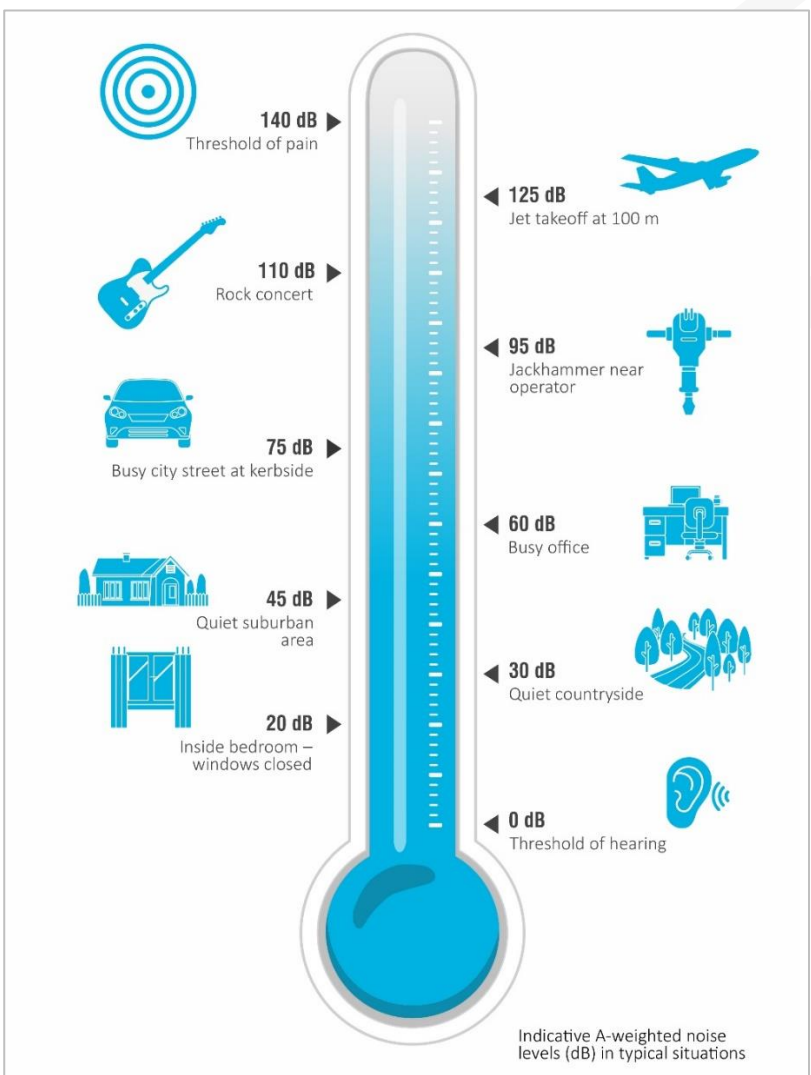


Figure A.1 Common noise levels

Appendix B

Regulator documents

PART B SPECIFIC ENVIRONMENTAL CONDITIONS

EARLY WORKS

- B1. The Applicant may prepare an Early Works Construction Environmental Management Plan for the Early Works, to the satisfaction of the Planning Secretary. This plan must:
- (a) describe measures to be implemented to minimise construction-related impacts on biodiversity, including:
 - (i) specific measures to minimise impacts on tree hollows, termite mounds and fauna; and
 - (ii) detailed procedures for pre-clearance surveys and supervision (by an appropriately qualified person) of the felling of habitat trees within disturbance areas associated with the Early Works;
 - (b) describe measures to be implemented to manage sediment and erosion risks, including:
 - (i) a detailed description of the surface water management measures to be implemented in relation to the Early Works; and
 - (ii) appropriate clean water diversion systems and construction of appropriate erosion and sediment controls for the management of disturbed areas associated with the Early Works;
 - (c) include a Trigger Action Response Plan which outlines actions to be undertaken to rectify impacts associated with erosion and sedimentation during the Early Works (to the extent that these actions are not addressed by other management plans required to be in place prior to the commencement of Early Works); and
 - (d) describe detailed procedures to be implemented to receive, record, handle and respond to complaints associated with the Early Works construction.
- B2. If the Applicant opts to seek approval for Early Works, the Applicant must not commence Early Works until the Early Works Construction Environmental Management Plan is approved by the Planning Secretary.
- B3. If the Planning Secretary approves an Early Works Construction Environmental Management Plan, the Applicant must implement that plan as approved by the Planning Secretary.

NOISE

Operational Noise Criteria

- B4. The Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 2 at any Residence on privately-owned land.

Table 2: Operational Noise Criteria dB(A)

Residences ^a	Day	Shoulder Period 6.00 am to 7.00 am Monday to Saturday	
	<i>L_{Aeq}</i> (15 minute)	<i>L_{Aeq}</i> (15 minute)	<i>L_A</i> (max)
2, 3, 5 ^b , 6, 7, 8, 9	45	45	55
4	54	52	62
10, 11	35	35	45
All other Residences	35	35	45

^a Residence locations are shown as "Assessment Locations" in Figure 6 in Appendix 3.

^b Receiver location 5 is representative of Residences in Menangle Village as identified in the red polygon on Figure 6 in Appendix 3.

Noise generated by the development must be measured in accordance with the relevant requirements and exemptions (including certain meteorological conditions) of the *NSW Industrial Noise Policy* (EPA, 2000). Appendix 4 sets out the meteorological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.

- B5. The noise criteria in condition B4 do not apply if the Applicant has an agreement with the owner/s of the relevant residence or land to exceed the noise criteria, and the Applicant has advised the Department in writing of the terms of this agreement.

Noise Operating Conditions

- B6. The Applicant must:
- (a) take all reasonable steps to minimise all noise from operational activities, including low frequency noise and other audible characteristics, as well as road noise associated with the development;
 - (b) take all reasonable steps to minimise the noise impacts of the development during noise-enhancing meteorological conditions, particularly when the noise criteria in this consent do not apply (see Appendix 4);
 - (c) carry out regular attended noise monitoring (every three months unless otherwise agreed with the Planning Secretary) to determine whether the development is complying with the relevant conditions of Schedule 2; and

- (d) regularly assess the noise monitoring data and modify or stop operations on the site to ensure compliance with the relevant conditions of Schedule 2.

Noise Management Plan

- B7. The Applicant must prepare a Noise Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:
- (a) be prepared by a suitably qualified and experienced person/s;
 - (b) be prepared in consultation with the EPA;
 - (c) describe the measures to be implemented to ensure:
 - (i) compliance with the noise criteria and operating conditions in this consent;
 - (ii) best practice noise management is being employed; and
 - (iii) noise impacts of the development are minimised during noise-enhancing meteorological conditions; under which the noise criteria in this consent do not apply (see Appendix 4); and
 - (d) include a monitoring program that:
 - (i) is capable of evaluating the performance of the development against the noise criteria;
 - (ii) monitors noise at the nearest and/or most affected residences; and
 - (iii) includes a protocol for identifying any noise-related exceedance, incident or non-compliance and for notifying the Department and relevant stakeholders of these events.
- B8. The Applicant must not commence Quarrying Operations in the Stage 8 Area until the Noise Management Plan is approved by the Planning Secretary.
- B9. The Applicant must implement the Noise Management Plan as approved by the Planning Secretary.

AIR QUALITY

Odour

- B10. The Applicant must ensure that no offensive odours (as defined under the POEO Act) are emitted by the development.

Air Quality Criteria

- B11. The Applicant must ensure that particulate matter emissions generated by the development do not cause exceedances of the criteria in Table 3 at any residence on privately-owned land.

Table 3: Air Quality Criteria

<i>Pollutant</i>	<i>Averaging period</i>	<i>Criterion</i>	
Particulate matter < 10 µm (PM ₁₀)	Annual	^{a, c} 25 µg/m ³	
	24 hour	^b 50 µg/m ³	
Particulate matter < 2.5 µm (PM _{2.5})	Annual	^{a, c} 8 µg/m ³	
	24 hour	^b 25 µg/m ³	
Total suspended particulate (TSP) matter	Annual	^{a, c} 90 µg/m ³	
^d Deposited dust	Annual	^b 2 g/m ² /month	^a 4 g/m ² /month

Notes:

^a Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).

^b Incremental impact (i.e. incremental increase in concentrations due to the development on its own).

^c Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Planning Secretary.

^d Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method

- B12. The air quality criteria in Table 3 do not apply if the Applicant has an agreement with the owner/s of the relevant residence to exceed the air quality criteria, and the Applicant has advised the Department in writing of the terms of this agreement.

Air Quality Operating Conditions

- B13. The Applicant must:

3 Noise criteria

Noise criteria for the facility are stipulated in Table 2 of development consent Condition B4. The noise criteria are specified for the day and shoulder periods and apply at all residential receivers which have the potential to be impacted by operational noise from the quarry (refer to Figure 3.1 for the nearest residential receivers). The noise criteria for the facility are reproduced in Table 3.1.

Table 3.1 Noise criteria

Residences ^a	Day	Shoulder period 6 am to 7 am Monday to Saturday	
		L _{Aeq,15 minute} dB(A)	L _{Amax} dB(A)
2, 3, 5 ^b , 6, 7, 8, 9	45	45	55
4	54	52	62
10, 11	35	35	45
All other Residences	35	35	45

Notes:

a Residence locations are shown as “Assessment Locations” in Figure 6 in Appendix 3 [of the Consent].

b Receiver location 5 is representative of Residences in Menangle Village as identified in the red polygon on Figure 6 in Appendix 3 [of the consent].

1. Day period is between 7 am–6 pm Monday to Saturday and 8 am–6 pm Sundays and Public Holidays.

2. Shoulder period is between 6 am–7 am Monday to Saturday.

Condition B4 also states:

Noise generated by the development must be measured in accordance with the relevant requirements and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy (EPA 2000). Appendix 4 sets out the meteorological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.

The noise criteria in Table 3.1 do not apply if Menangle Sand and Soil has negotiated an agreement with the owner/s of the relevant residence or land to exceed the noise criteria. As of the date of this report, Menangle Sand and Soil have not negotiated any agreements with any landowners or residents. As per Condition B5 of Schedule 2, Menangle Sand and Soil will advise the relevant authorities in writing of the terms of any negotiated agreements.

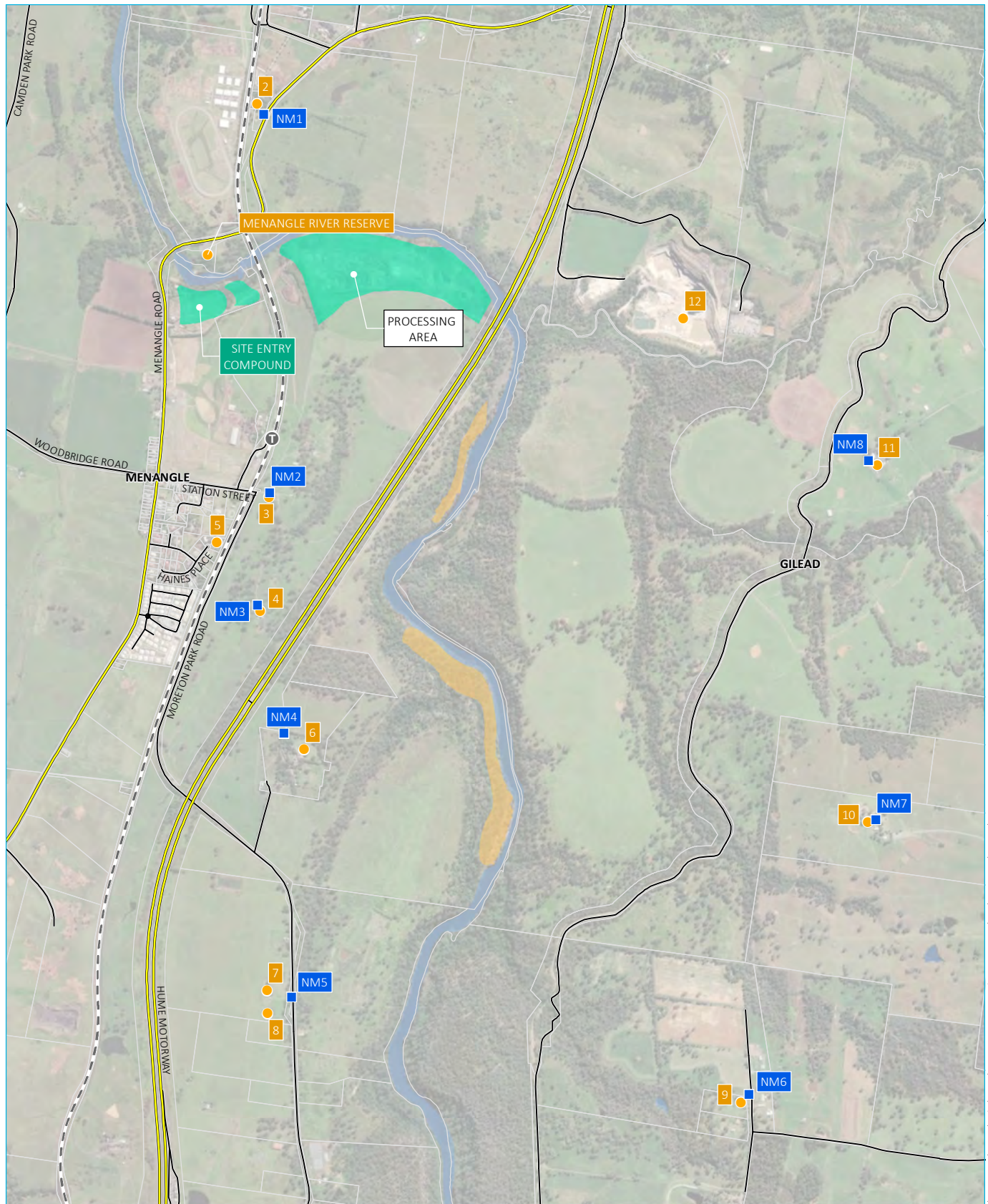
Compliance monitoring will adhere to the requirements of the EPA’s policies and guidelines.

As per Condition 3 of Appendix 4, a noise compliance assessment will be undertaken within two months of commencement of Quarrying Operations in the Stage 8 Area, with a report provided to the EPA within 1 month of the assessment. The assessment will be conducted by a suitably qualified and experienced acoustical practitioner and will assess compliance with noise criteria outlined in Table 3.1.

3.1 Sensitive receivers

The nearest noise sensitive receivers most likely to be affected by operational noise from the site is long-term living accommodation approximately 700 m to the south-west/west of the Stage 8 extraction area. There are also surrounding industrial premises including the Camden Coal Seam Gas (CSG) plant (no longer operational) and the Hi-Quality Menangle Park Quarry, which is approximately 300 m to the north-east of Stage 8 operations. Menangle River Reserve is approximately 1.3 km west of Stage 8 operations.

Figure 3.1 shows the site boundary, the nearest sensitive receivers and the attended noise monitoring locations.



KEY

- Monitoring location
- Assessment location
- ⓘ Train station
- Rail line
- Main road
- Local road
- Nepean River
- ▭ Cadastral boundary
- Extractive operations
- Stage 8

Site boundary, sensitive receivers
and noise monitoring locations

Menangle Sand and Soil
Noise management plan
Figure 3.1

5 Noise monitoring

5.1 Objective

The following conditions related to noise monitoring were included in the project consent under Condition B6 and have been reproduced below:

B6. The Applicant must:

- (c) carry out regular attended noise monitoring (every three months unless otherwise agreed with the Planning Secretary) to determine whether the development is complying with the relevant conditions of Schedule 2; and
- (d) regularly assess the noise monitoring data and modify or stop operations on the site to ensure compliance with the relevant conditions of Schedule 2.

The noise monitoring program is designed to verify that noise emissions from the quarry complies with the relevant noise criteria at the most affected residential receivers.

5.2 Noise monitoring standards

Noise monitoring will be undertaken in accordance with the relevant Australian standards and EPA guidelines including:

- AS 1055.1-2018 Acoustics – Description and Measurement of Environmental Noise – General Procedures;
- AS IEC 61672.1-2019 ‘Electroacoustics – Sound Level Meters – Specifications’;
- INP (EPA 2000) and Application Notes; and
- NPfI (EPA 2017).

It is noted that the INP has been replaced by the NPfI. However, the INP continues to apply in accordance with the EPA’s *Implementation and Transitional Arrangements for the Noise Policy for Industry* (EPA 2017) where the INP is referenced in existing statutory instruments, as is the case from Menangle Quarry).

Further, the INP Application Notes state that Section 4 of the INP has been withdrawn and the modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing potentially annoying characteristics of a noise source. Fact sheet C of the Npfl (EPA 2017) provides guidelines for applying corrections to account for annoying noise characteristics such as tonal noise and low frequency noise.

The INP and Fact Sheet C of the Npfl have been adopted for the purpose of this NMP.

All acoustic instrumentation proposed for monitoring under the noise monitoring program will have current NATA or manufacturer calibration certificates as per the relevant Australian standards.

5.3 Noise monitoring locations

Quarterly attended monitoring locations will be representative of the nearest privately owned receptors to active operations at the time of monitoring. The pool of attended monitoring locations are listed in Table 5.1 and shown on Figure 3.1. A selection of attended monitoring locations will be used each quarter from a pool of eight locations to represent the nearest affected privately-owned residences.

In order to satisfy Conditions B4 and B6, Menangle Sand and Soil will conduct quarterly attended noise monitoring at a representative sample of the points identified in Table 5.1 and shown in Figure 3.1. Data used for determining meteorological conditions will be sourced from the on-site meteorological station.

Table 5.1 Pool of attended noise monitoring locations

ID	Description	Easting (MGA)	Northing (MGA)	Representative residences	Representative direction
NM1	Menangle Road North	291937	6223124	R2	NW
NM2	Station Street North	291964	6221374	R3, R5	W
NM3	Station Street East	291907	6220855	R4	W
NM4	Morton Park Road North	292028	6220262	R6	SW
NM5	Morton Park Road South	292064	6219045	R7, R8	SW
NM6	Bulli Appin Road South	294179	6218595	R9	SE
NM7	Bulli Appin Road North	294766	6219863	R10	E
NM8	Appin Road	294732	6221523	R11	NE

5.4 Noise monitoring program

The attended noise monitoring will be completed on a quarterly basis to verify that noise emissions from the facility satisfy the relevant noise criteria at representative residential receivers. The attended noise monitoring program will be used to:

- estimate the site noise contribution from the measured noise levels;
- determine the individual noise sources contributing to the ambient noise environment wherever possible;
- determine whether a correction for annoying noise characteristics should be applied to the site noise level before comparison with the relevant noise criteria in accordance with the Npfl; and
- gain an understanding of the effects of meteorological conditions on the propagation of noise from site to surrounding residential receivers.

The attended noise monitoring will be completed during the morning shoulder (6 am–7 am) and day (7 am–6 pm) periods.

During the morning shoulder period, attended noise monitoring will only occur at NM4, as NM4 is the only assessment location with a more stringent morning shoulder noise criteria compared with daytime noise criteria.

During the day period, the noise monitoring locations selected for each monitoring event will be dependent on the location of quarrying operations and the meteorological conditions present on the day of the noise monitoring. As such, the quarterly noise monitoring events will target the worst affected noise monitoring locations from the pool detailed in Table 5.1.

In summary, each quarterly monitoring event will entail:

- attended noise monitoring at NM4 during the morning shoulder period (6 am–7 am); and

- attended noise monitoring at the predicted worst-case noise monitoring locations (selected based on quarry operations and meteorological conditions) during the day period (7 am–6 pm).

For each 15-minute attended noise measurement, the following information will be recorded:

- name of monitoring personnel;
- monitoring location;
- date(s) and time(s) at which the monitoring measurement started and ended at each location;
- height of the microphone above the ground and, if relevant, distances to building facades or property boundaries (if monitoring cannot be completed within the property boundary);
- quantitative meteorological data such as wind speed (including the height above ground at which the measurement was taken), wind direction, temperature and humidity;
- qualitative meteorological information such as cloud cover, fog or rainfall;
- instrument type and in-field calibration details before and after the monitoring period;
- the $L_{Aeq,15min}$ noise level for the 15-minute period;
- statistical noise level descriptors over the 15-minute interval: L_{Amin} , L_{A90} , L_{A10} , L_{A1} and L_{Amax} ;
- notes that identify the noise sources that contribute to the overall noise environment;
- an estimate of the noise contribution from the facility and from other identifiable noise sources;
- measurement in one-third octave bands from 10 Hz to 8 kHz inclusive (or a broader range of bands) for the 15-minute interval to assess if site noise exhibit tonal characteristics that may require the application of a correction for annoying noise characteristics in accordance with Fact Sheet C of the NPfI. The method for determining if a correction for tonal noise is applicable is presented in Section 5.8.1;
- measurement of C-weighted and A-weighted site noise levels to identify the likely presence of low frequency noise in accordance with Fact Sheet C of the NPfI. The method for determining if a correction for low frequency noise is applicable is presented in Section 5.8.2;
- data suitable for assessing the relative contribution of site noise to the overall noise level being measured by using a low-pass filter, which will be developed during the first round of monitoring (eg with a low-pass frequency of 630 Hz); and
- recommendations or comments where considered appropriate.

In accordance with the methodology outlined in Section 3 of the INP (EPA 2000), if any of the data in a 15-minute period is affected by rain or wind speeds in excess of 3 m/s, and where possible, another entire 15-minute period of data unaffected by rain or adverse wind conditions shall be undertaken.

5.5 Instrumentation

All noise monitoring instrumentation will meet the requirements of AS IEC 61672.1-2019 and carry current NATA or manufacturer calibration certificates. Instrument in-field calibration will be checked before and after each survey, with the variation in calibrated levels not exceeding ± 0.5 dB.

The sound level meter will be programmed to record statistical noise level indices continuously for each 15-minute interval, including L_{A1} , L_{A10} , L_{A90} , L_{Amin} , L_{Aeq} and L_{Amax} , using 'fast' time response.

5.6 Meteorological monitoring

Condition B17 of the development consent relates to the establishment of a meteorological monitoring station in the vicinity of the quarry and states the following:

Prior to the commencement of Quarrying Operations in the Stage 8 Area, and for the life of the development, the Applicant must ensure that there is a suitable meteorological station operating in close proximity to the site that:

- (a) complies with the requirements in the Approved Methods for Sampling and Analysis of Air Pollutants in New South Wales (DEC 2007); and
- (b) is capable of measuring meteorological conditions in accordance with the NSW Industrial Noise Policy (EPA 2000),

unless a suitable alternative is approved by the Planning Secretary following consultation with the EPA.

The meteorological station at the quarry will be located to the east of the site entry compound and will satisfy requirements of the NSW Industrial Noise Policy and Australian Standard AS 3580.14-2014 *Methods for sampling and analysis of ambient air Part 14: Meteorological monitoring for ambient air quality monitoring applications*.

5.7 Meteorological parameters

Consent Condition B4 states:

Noise generated by the development must be measured in accordance with the relevant requirements and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy (EPA 2000). Appendix 4 sets out the meteorological conditions under which these criteria apply and the requirements for evaluating compliance with these criteria.

The meteorological conditions during the noise monitoring will be recorded including wind speed (including the height above ground at which the measurement was taken), wind direction, temperature, humidity, cloud cover and the presence of fog and rain (if any).

The meteorological conditions will be used to determine if the noise criteria (refer to Table 3.1) apply in accordance with the INP. Condition 1 of Appendix 4 states that:

The noise criteria in condition B4 of Schedule 2 are to apply under all meteorological conditions except the following:

- (a) where $3^{\circ}\text{C}/100$ metres (m) lapse rates have been assessed, then:
 - (i) wind speeds greater than 3 metres/second (m/s) measured at 10m above ground level;
 - (ii) temperature inversion conditions between 1.5°C and $3^{\circ}\text{C}/100\text{m}$ and wind speeds greater than 2m/s measured at 10m above ground level; or

- (iii) temperature inversion conditions greater than 3°C/100m.
- (b) where Pasquill Stability Classes have been assessed, then:
 - (i) wind speeds greater than 3m/s at 10m above ground level;
 - (ii) stability category F temperature inversion conditions and wind speeds greater than 2m/s at 10m above ground level; or
 - (iii) stability category G temperature inversion conditions.

5.8 Corrections for annoying noise characteristics

The INP application notes state that Section 4 of the INP has been withdrawn and the corrections outlined in Fact Sheet C of the NPfI are to be used when assessing the characteristics of a noise source. The NPfI specifies corrections for noise with annoying characteristics such as tonal noise and low frequency noise. These are discussed in the following sections.

5.8.1 Tonal noise

Tonal noise can be defined as noise levels containing a prominent frequency and characterised by a definite pitch. Examples of tonal noise sources include ventilation fans, reversing beepers or alarms. The method for assessing the presence of tonal noise involves comparing differences in noise levels between neighbouring one-third octave centre frequency bands.

Fact sheet C of the NPfI provides guidelines for applying a correction to account for tonal noise emissions. The NPfI specifies that a 5 dB positive adjustment is applicable where the level of any of the one-third octave bands exceeds the level of both adjacent bands by:

- 5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 Hz;
- 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz; or
- 15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz.

5.8.2 Low frequency noise

Low frequency noise can be characterised as noise containing dominant energy within the low frequency range (ie less than 200 Hz). Examples of low frequency noise sources can include screens and centrifuges in coal washeries, as well as pumps, fans, boilers, ventilation plant, electrical installations and wind turbines.

Fact sheet C of the NPfI provides guidelines for applying a correction to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced spectrum and potential increased annoyance. Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the measured one-third octave noise levels should be compared to the values in Table C2 of the NPfI, which has been reproduced in Table 5.2.

Table 5.2 One-third octave low-frequency noise thresholds

	One-third octave $L_{Zeq,15min}$ threshold level												
Frequency (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB (Z)	92	89	86	77	69	61	54	50	50	48	48	46	44

The following correction is to be applied where the site 'C-weighted' minus site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 5.2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured A-weighted levels applies for the evening/night period; or
- where any of the one-third octave noise levels in Table 5.2 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured A-weighted levels applies for the evening/night period and a 2 dB positive adjustment to measured A-weighted levels applies for the day period.

Hence, where possible throughout each survey the difference between site 'C-weighted' and site 'A-weighted' noise emission levels will be estimated by the operator by matching audible sounds with the response of the analyser ($L_{Ceq}-L_{Aeq}$). Where this is deemed to be 15 dB or greater, the measured one-third octave frequencies will be compared to the values in Table 5.2 to identify the relevant correction (if applicable). It is of note that the NPfI states that low frequency noise correction does not apply during adverse meteorological conditions, including during wind speeds above 3 m/s at 10 m above ground level, stability category F with wind speeds above 2 m/s at 10 m above ground level, or during stability category G.

5.9 Data analysis

The $L_{Aeq,15min}$ noise level contribution from the facility as well as the overall ambient noise levels together with the weather and site operating conditions will be reported on a quarterly basis.

The contributed noise emissions from operations at the facility will be evaluated and assessed against the noise level criteria given in Table 2 of development consent Condition B4 (refer to Table 3.1) during each quarterly noise monitoring event. Compliance may be determined by:

- post analysis of data (including through the review of audio recordings);
- direct measurement against the $L_{Aeq,15min}$ criteria;
- operator estimated $L_{Aeq,15min}$ contribution;
- by calculation from near field measurements;
- by measurement at a representative location; or
- a combination of any or all the above methods as approved by the EPA or in accordance with the INP or NPfI as relevant.

5.10 Noise exceedance protocol

If attended noise monitoring identifies that the noise criteria as per Table 3.1 have been exceeded, the person conducting the attended noise monitoring will follow the noise exceedance protocol presented in Figure 5.1.

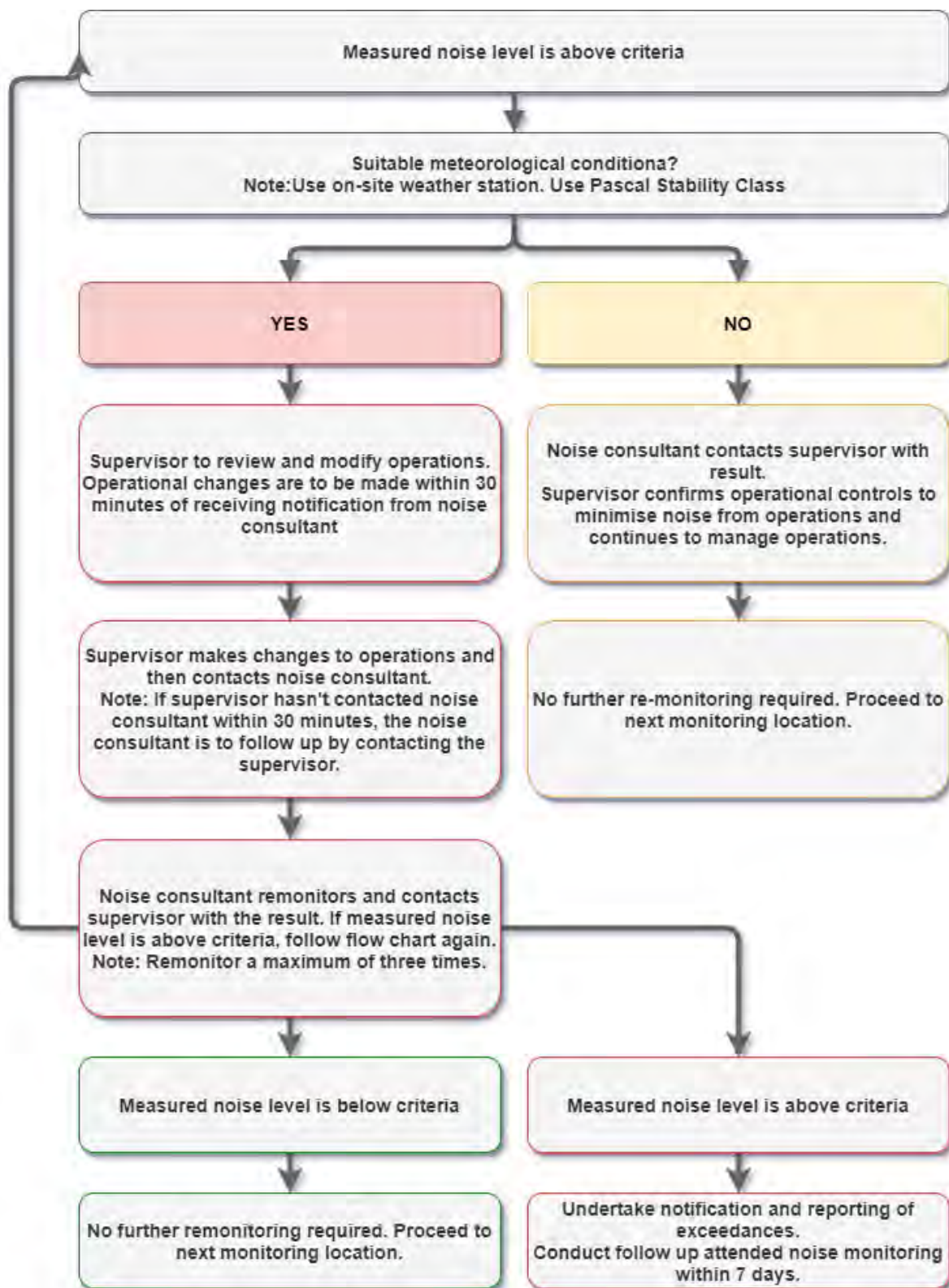


Figure 5.1 Noise exceedance protocol

The relevant supervisor will document and report to the Quarry Manager any actions implemented following the notification of the exceedance. The exceedance is required to be reported to DPE and EPA by the Quarry Manager (or delegate) immediately upon Menangle Sand and Soil becoming aware of the exceedance. An additional attended noise monitoring survey will be completed within one week if the exceedance could not be effectively reduced below the relevant criteria on the night of noise monitoring.

Within 7 days of detecting an exceedance of the noise criteria as per Table 3.1, Menangle Sand and Soil shall provide a written report of the exceedance to DPE. This report must:

- describe the date, time, and nature of the exceedance/incident;
- identify the cause (or likely cause) of the exceedance/incident;
- describe what action has been taken to date; and
- describe the proposed measures to address the exceedance/incident.

Any exceedance above the noise limits identified in Table 3.1 will be reported in the annual noise compliance assessment report required under Condition R4.3 of EPL and noise monitoring reports will be available upon request.

5.11 Noise monitoring report

All routine monitoring results will be documented and reported initially on a quarterly basis.

Quarterly reports will consist of the following information:

- summary of all attended noise monitoring results;
- measured, calculated and/or operator estimated site $L_{Aeq,15min}$ contributed noise levels for each monitoring location;
- statement of compliance/non-compliance; and
- details of any complaints relating to noise and their state of resolution.

The noise monitoring contractor undertaking the monitoring on behalf of Menangle Sand and Soil will provide the site representative with a monitoring report outlining the results and outcome of the survey.

The site representative will review the monitoring report provided by the contractor to assess compliance with the criteria outlined in Table 2 of development consent Condition B4 (refer to Table 3.1). A summary of quarterly noise monitoring results will be published on the Menangle Sand and Soil website, as per Condition D15.

Appendix C

Calibration certificates



**Acoustic
Research
Labs Pty Ltd**


Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter

IEC 61672-3:2013

Calibration Certificate

Calibration Number C23471

Client Details		EMM Consulting Ground Floor Suite 01, 20 Chandos Street
Equipment Tested/ Model Number :		Type 2250
Instrument Serial Number :		3008201
Microphone Serial Number :		2888134
Pre-amplifier Serial Number :		16037
Firmware Version :		N/A
Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions
Ambient Temperature : 23.1 °C		Ambient Temperature : 24.3 °C
Relative Humidity : 44 %		Relative Humidity : 44.1 %
Barometric Pressure : 101.6 kPa		Barometric Pressure : 101.3 kPa
Calibration Technician : Max Moore		Secondary Check: Rhys Gravelle
Calibration Date : 12 Jul 2023		Report Issue Date : 17 Jul 2023
Approved Signatory : 		Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	Pass	17: Level linearity incl. the level range control	N/A
13: Electrical Sig. tests of frequency weightings	Pass	18: Toneburst response	Pass
14: Frequency and time weightings at 1 kHz	Pass	19: C Weighted Peak Sound Level	Pass
15: Long Term Stability	Pass	20: Overload Indication	Pass
16: Level linearity on the reference level range	Pass	21: High Level Stability	Pass

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation test performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2013.

		Uncertainties of Measurement -	
		Environmental Conditions	
Acoustic Tests		<i>Temperature</i>	± 0.1 °C
125Hz	± 0.13 dB	<i>Relative Humidity</i>	± 1.9 %
1kHz	± 0.13 dB	<i>Barometric Pressure</i>	± 0.014 kPa
8kHz	± 0.14 dB		
Electrical Tests	± 0.13 dB		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.



This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

CERTIFICATE OF CALIBRATION

CERTIFICATE No: **C36957**

EQUIPMENT TESTED : Sound Level Calibrator

Manufacturer: Svantek

Type No: SV36 Serial No: 138019

Owner: EMM Consulting
Suite 01, 20 Chandos St
St Leonards NSW 2065

Tests Performed: Measured Output Pressure level, Frequency & Distortion

Comments: See Details overleaf. All Test Passed.

Parameter	Pre-Adj	Adj Y/N	Output: (dB re 20 µPa)	Frequency (Hz)	THD&N (%)
Level1:	NA	N	93.94 dB	999.97 Hz	0.63 %
Level2:	NA	N	113.97 dB	999.97 Hz	0.40 %
Uncertainty			±0.11 dB	±0.05%	±0.20 %
Uncertainty (at 95% c.i.) k=2					

CONDITION OF TEST:

Ambient Pressure 1012 hPa ±1 hPa
Temperature 23 °C ±1° C
Relative Humidity 40 % ±5%

Date of Receipt : 28/07/2023
Date of Calibration : 01/08/2023
Date of Issue : 01/08/2023

Acu-Vib Test AVP02 (Calibrators)

Procedure: Test Method: AS IEC 60942 - 2017

CHECKED BY:

AUTHORISED
SIGNATURE:

Hein See

Accredited for compliance with ISO/IEC 17025 - Calibration

Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.



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Acoustic and Vibration
Measurements

Acu-Vib Electronics
CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory
Unit 14, 22 Hudson Ave. Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

Australia

SYDNEY

Ground floor 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500

NEWCASTLE

Level 3 175 Scott Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE

Level 1 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

CANBERRA

Suite 2.04 Level 2
15 London Circuit
Canberra City ACT 2601

ADELAIDE

Level 4 74 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE

Suite 8.03 Level 8
454 Collins Street
Melbourne VIC 3000
T 03 9993 1900

PERTH

Suite 9.02 Level 9
109 St Georges Terrace
Perth WA 6000
T 08 6430 4800

Canada

TORONTO

2345 Yonge Street Suite 300
Toronto ON M4P 2E5
T 647 467 1605

VANCOUVER

60 W 6th Ave
Vancouver BC V5Y 1K1
T 604 999 8297



[linkedin.com/company/emm-consulting-pty-limited](https://www.linkedin.com/company/emm-consulting-pty-limited)



emmconsulting.com.au

Memorandum

19 March 2025

To: Ewen McKenzie
Project Manager
Menangle Sand and Soil Pty Limited
15 Menangle Road
Menangle, NSW 2568

From: Henry Noakes

Subject: Menangle Quarry: Groundwater data review for 2024

Dear Ewen,

EMM Consulting Pty Limited (EMM) have undertaken a groundwater data review (the review) on behalf of Menangle Sand and Soil Pty Limited (the client), for the 2024 calendar year (the reporting period). The review was undertaken to support an annual review (to be prepared by the client) for the Menangle Quarry, located at 15 Menangle Road, Menangle NSW 2568 (the quarry).

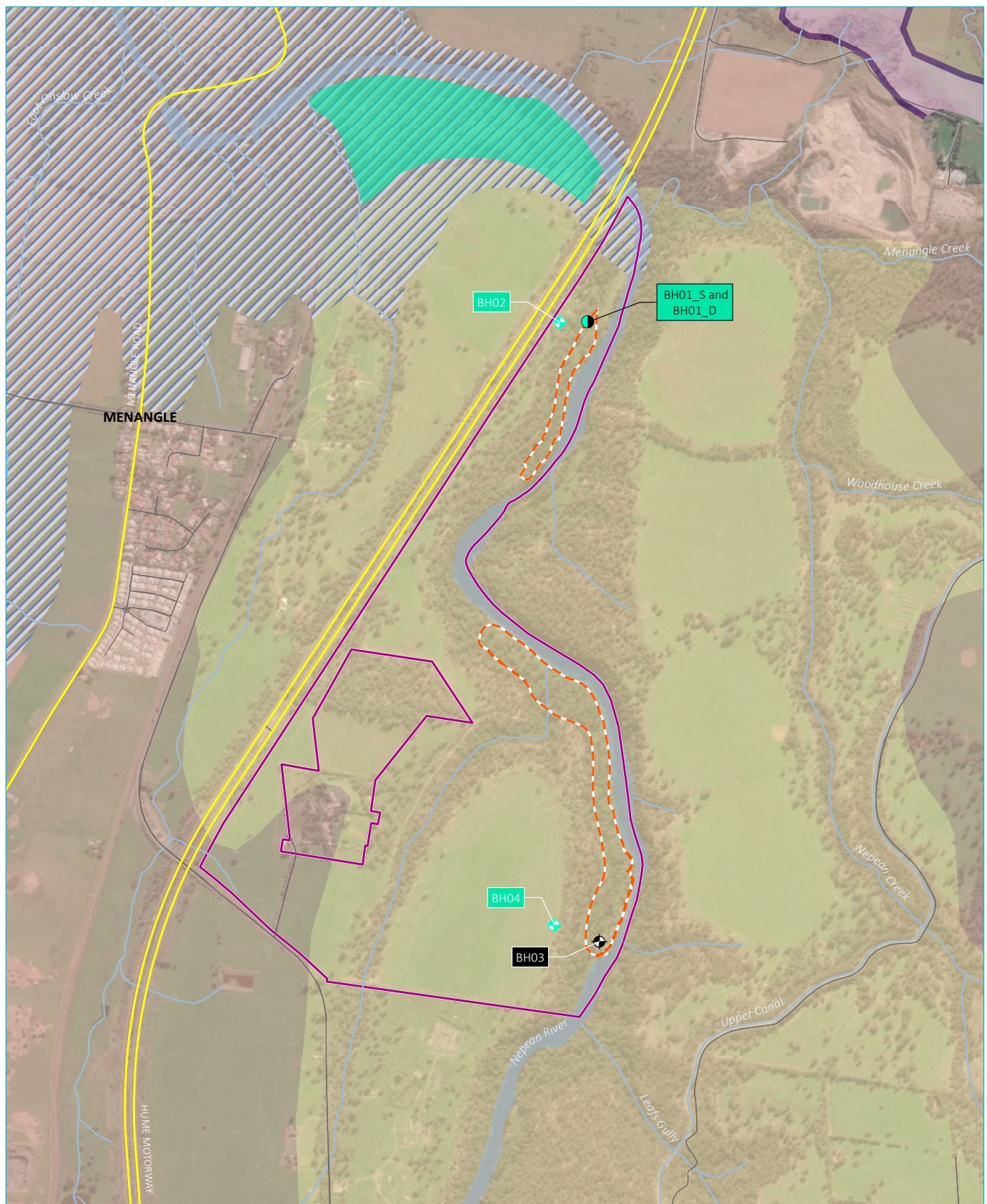
The quarry extracts sand and soil along the Nepean River, as approved by Development Consent 85/2865, granted by the Minister for Planning on 15 November 1989, and modified (Modification 1) by the NSW Land and Environment Court in September 2020 to extract alluvial material from the Stage 8 area (refer Figure 1). Based on conversations with the client, EMM understands that extraction from the Stage 8 area commenced in September 2023.

In accordance with the proposal provided on 7 March 2025¹, this memorandum provides:

- a review of available groundwater data, comprising presentation of groundwater level hydrographs and groundwater quality data against representative trigger levels, as documented in the soil and water management plan² (SWMP)
- comment on any exceedances of groundwater level and quality trigger values (in accordance with the SWMP), considering nearby project activities
- recommendations for ongoing monitoring and trigger levels, in accordance with the requirements of the SWMP.

¹ EMM proposal document *E250216_P1_MenagleQuarryGwandSw_v1-0*, dated 7 March 2025

² Menangle Sand and Soil Quarry - Soil and Water Management Plan, *J190166_27_Menangle Quarry_SWMP_v5*, dated 9 September 2024



Source: EMM (2020); DFSI (2017); GA (2011), DPE (2015)

KEY

- Study area
- Menangle Quarry - Stage 7
- Stage 8 extraction area
- Main road
- Local road Watercourse/
- drainage line Named
- waterbody

- Location Type
- Borehole - alluvium
 - + Borehole - sandstone
 - Borehole - alluvium & sandstone

- Surface geology
- Alluvium
 - Ashfield shale
 - Bringelly shale
 - Hawkesbury sandstone
 - Minchinbury sandstone

Groundwater monitoring
network location plan

Menangle Quarry
Groundwater data review (2024)
Figure 1

Groundwater monitoring network

The site includes a dedicated groundwater monitoring network, comprising five monitoring bores (bores) near the Stage 8 extraction area (refer Figure 1). A summary of the groundwater monitoring network is provided in Table 1 and bore locations are provided on Figure 1.

Table 1 Monitoring location summary

Location	¹ Easting	¹ Northing	Ground elevation (² mAHD)	Screen top (³ mbgl)	Screen base (³ mbgl)	Target lithology
BH01_Shallow	292937.4	6221762.2	66.73	4.4	7.4	Alluvium
BH01_Deep	292933.9	6221758.0	67.04	8.5	11.5	Hawkesbury Sandstone
BH02	292844.3	6221762.2	87.62	33	39	Hawkesbury Sandstone
BH03	292976.3	6219699.0	65.71	20	23	Alluvium
BH04	292825.7	6219754.3	105.92	54	60	Hawkesbury Sandstone

Notes: 1. Projected in GDA 1994 / MGA Zone 56 2. Metres Above Australian Height Datum 3. metres below ground level

Groundwater monitoring summary

Monitoring was undertaken in accordance with the SWMP over the reporting period, comprising:

- quarterly groundwater level monitoring (see Section 6.4.1 of the SWMP), typically undertaken by the client and comprising a manual dip measurement and download of the automated loggers installed within each bore (undertaken by the client)
- annual groundwater quality monitoring (see Section 6.4.2 of the SWMP) undertaken by EMM and comprising acquisition of one groundwater sample, per bore, for:
 - measurement of in-field parameters measurements (pH, electrical conductivity, temperature, dissolved oxygen and oxidation/reduction potential) using a hand-held water quality meter
 - submission to an analytical lab for analysis of general water quality (pH, electrical conductivity, total dissolved solids, hardness and alkalinity), major ions (calcium, chloride, fluoride, sodium, magnesium, potassium, sulphate, and an ionic balance) and dissolved metals (arsenic, cadmium, chromium, copper, nickel, lead, and zinc).

Further information on the 2024 water quality monitoring event is provided in the *Menangle Groundwater Monitoring Report - April 2024*, dated 2 May 2024.

Table 2 provides a summary of monitoring data collected over the reporting period.

Table 2 **Menangle Quarry - Record of 2024 monitoring events**

Event	Date	Location / ¹ parameters monitored				
		BH01_Shallow	BH01_Deep	BH02	BH03	BH04
1	12 January 2024	ML	ML + AL	ML + AL	ML	ML + AL
2	10 April 2024	ML + Q	ML + AL + Q	ML + AL + Q	ML + AL + Q	ML + AL + Q
3	1 July 2024	ML	ML + AL	ML + AL	-	AL
4	30 September 2024	ML	ML + AL	ML	-	-
5	20 December 2024	ML	ML	ML	ML	ML

Notes: 1. ML = Manual groundwater level data obtained; AL = Automated groundwater level data (from logger) successfully downloaded;
Q = Groundwater quality sample retrieved and successfully measured / analysed.

Groundwater level review

The SWMP presents groundwater minimum level trigger values (i.e. measured data is considered an exceedance if below the trigger value) at each location within the monitoring network. Groundwater minimum level trigger values were derived from numerical groundwater modelling predictions and baseline data.

During the reporting period, no exceedances of groundwater level trigger values were recorded.

Table 3 presents a summary of groundwater level trigger values. Groundwater level hydrographs³ are provided, at respective monitoring locations, in Figure 2 to Figure 6.

Table 3 **Groundwater level trigger values**

Location	Groundwater low-level trigger value (¹ mAHD)
BH01_Shallow	59.27
BH01_Deep	59.29
BH02	60.29
BH03	59.20
BH04	60.70

Source: Menangle Sand and Soil Quarry - Soil and Water Management Plan, dated 9 September 2024

Notes: 1. Metres above Australian Height Datum 2. Or simply delete these lines of text if not required.

³ In order to remove sampling induced drawdown, data has been filtered to remove interference.

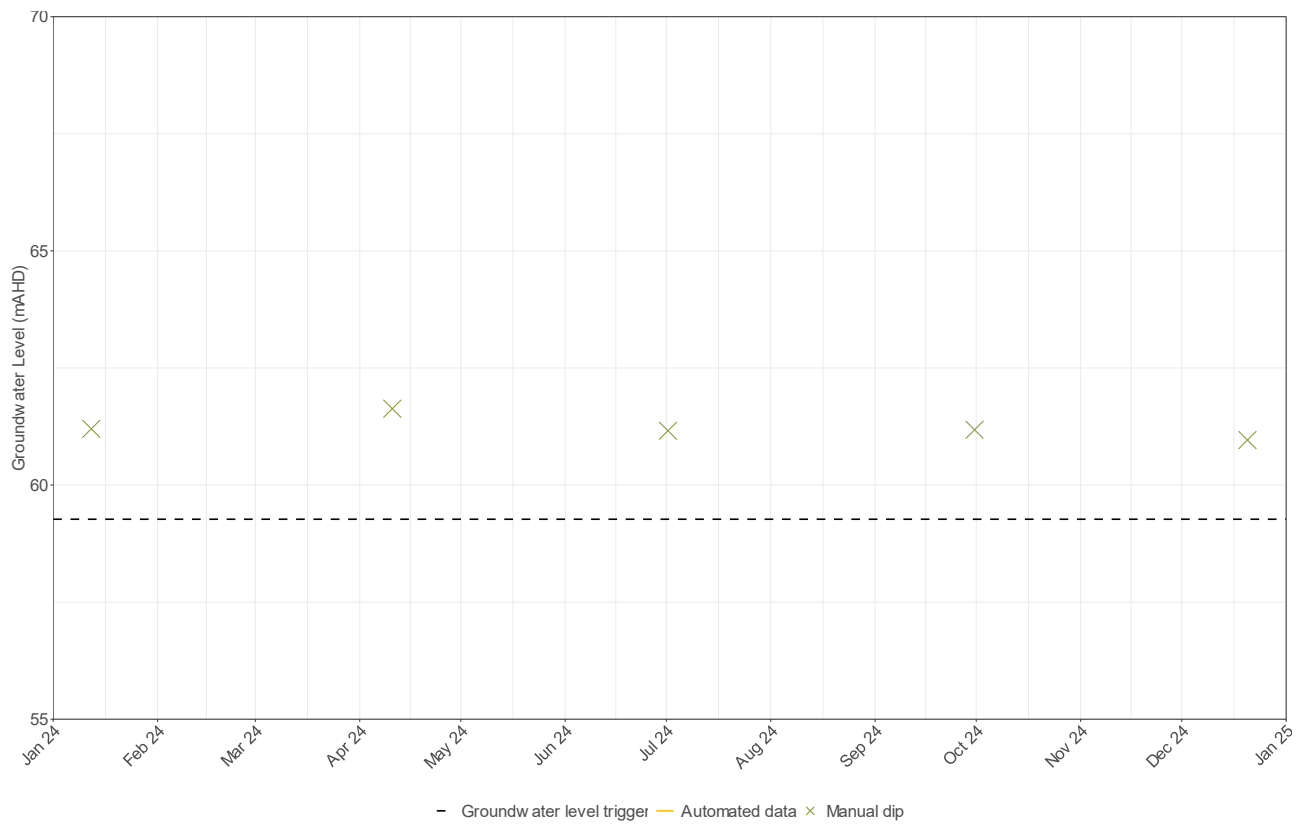


Figure 2 BH01_Shallow groundwater level hydrograph

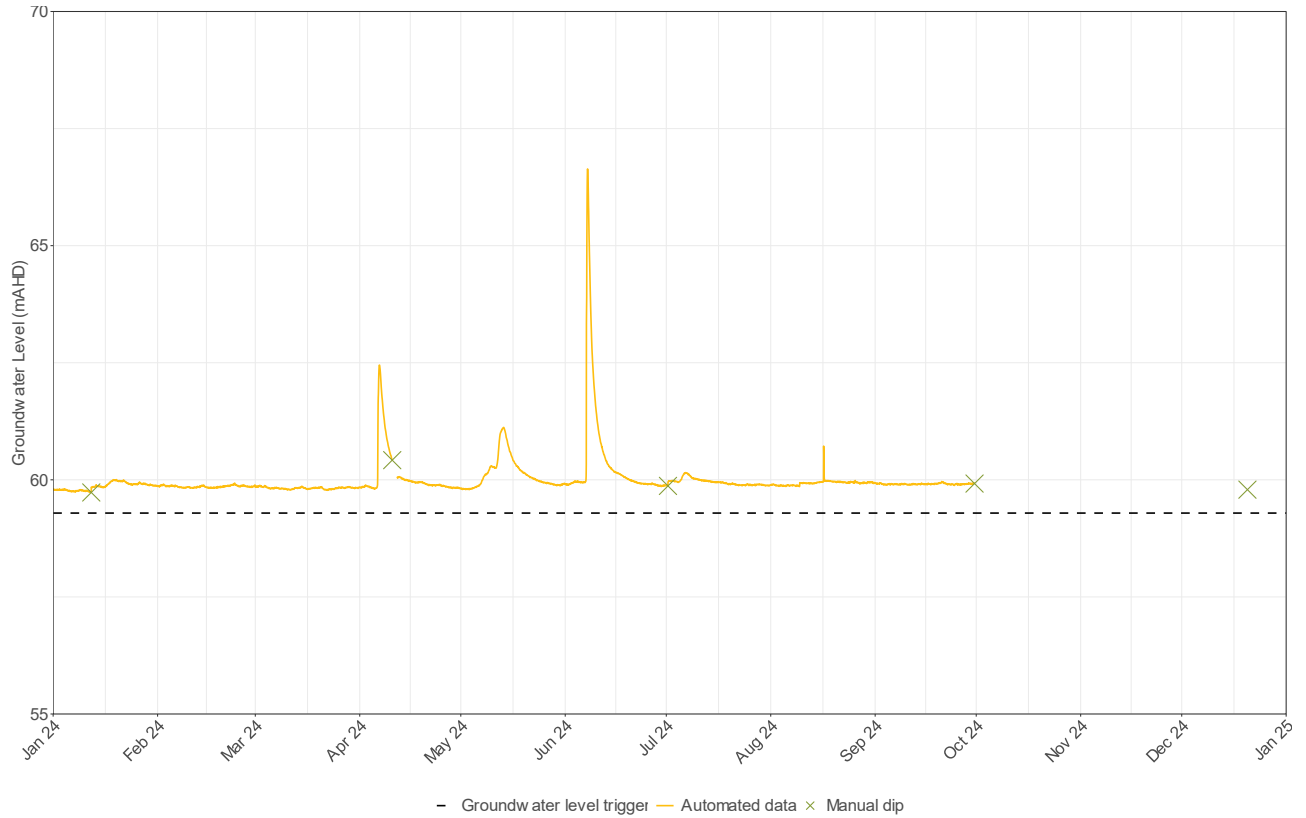


Figure 3 BH01_Deep groundwater level hydrograph

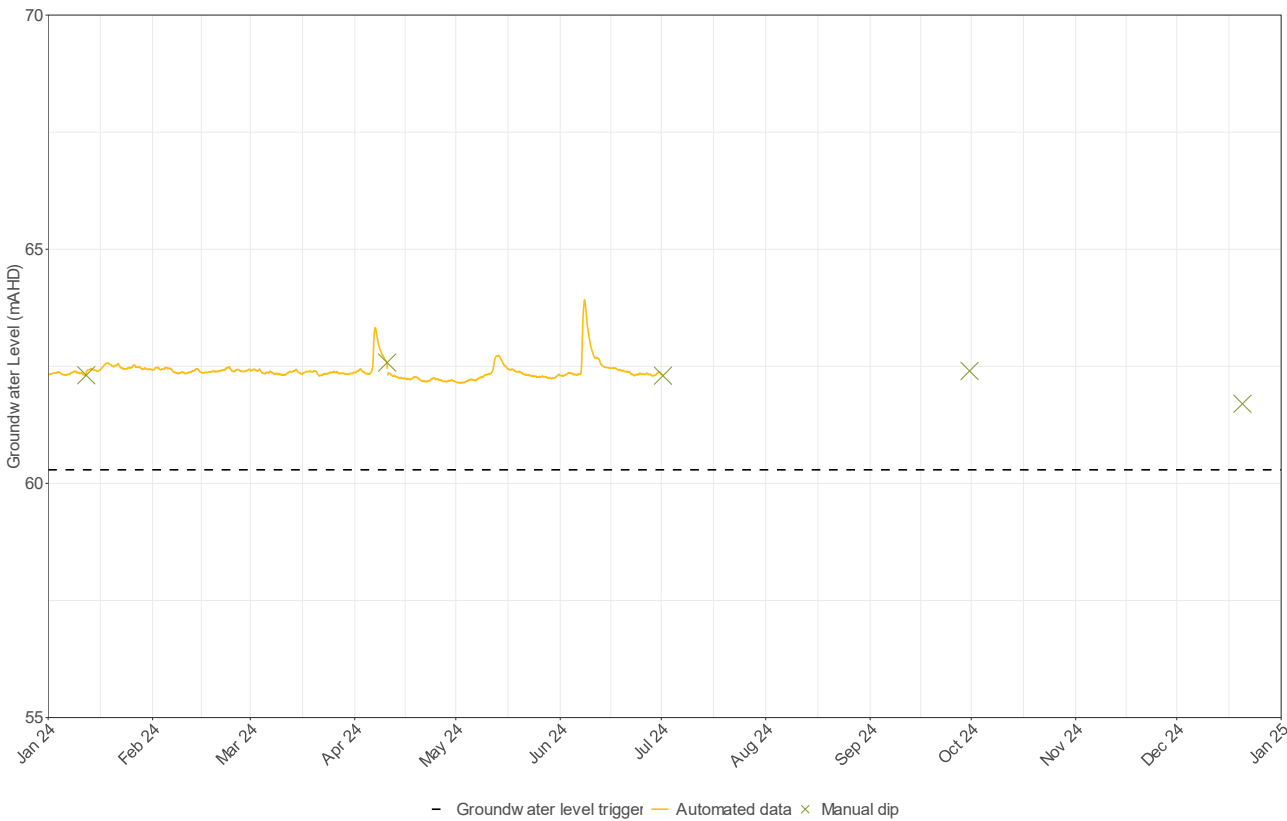


Figure 4 BH02 groundwater level hydrograph

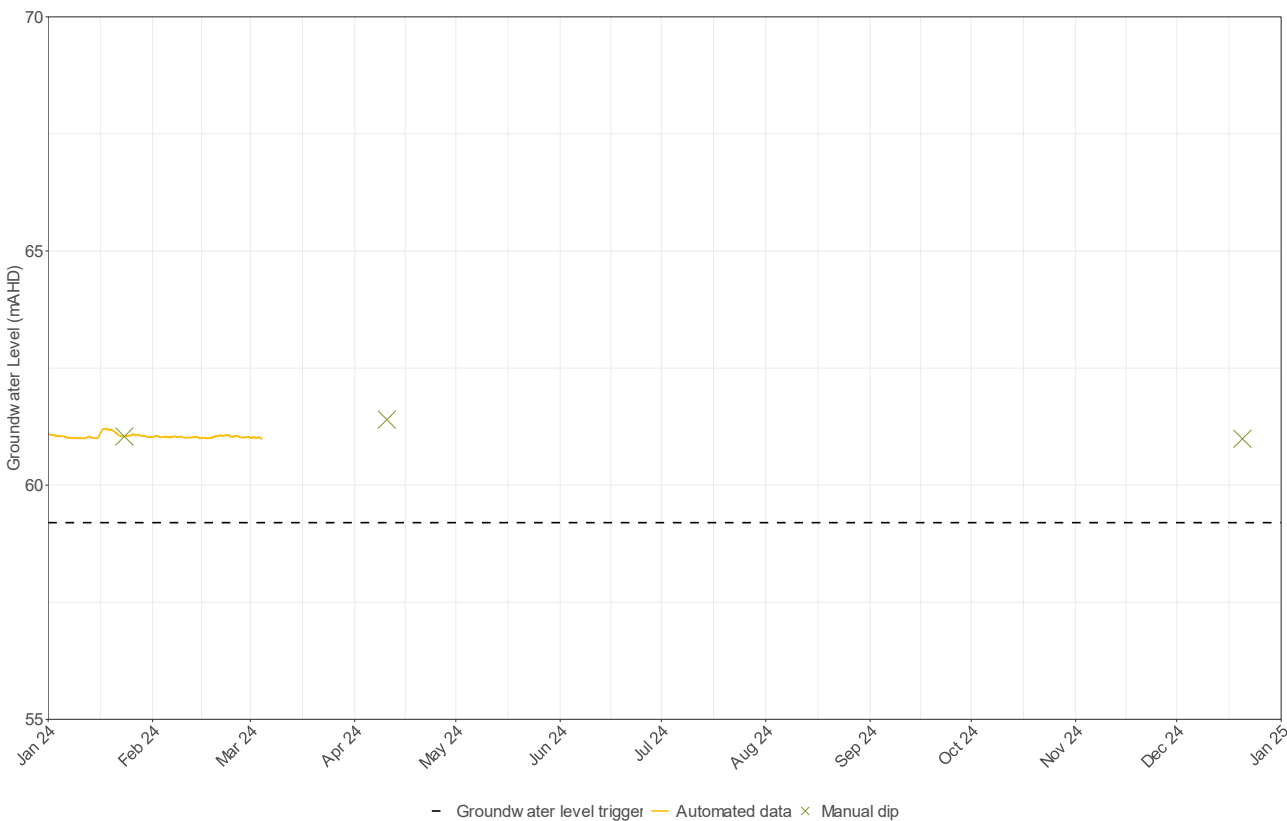


Figure 5 **BH03 groundwater level hydrograph**

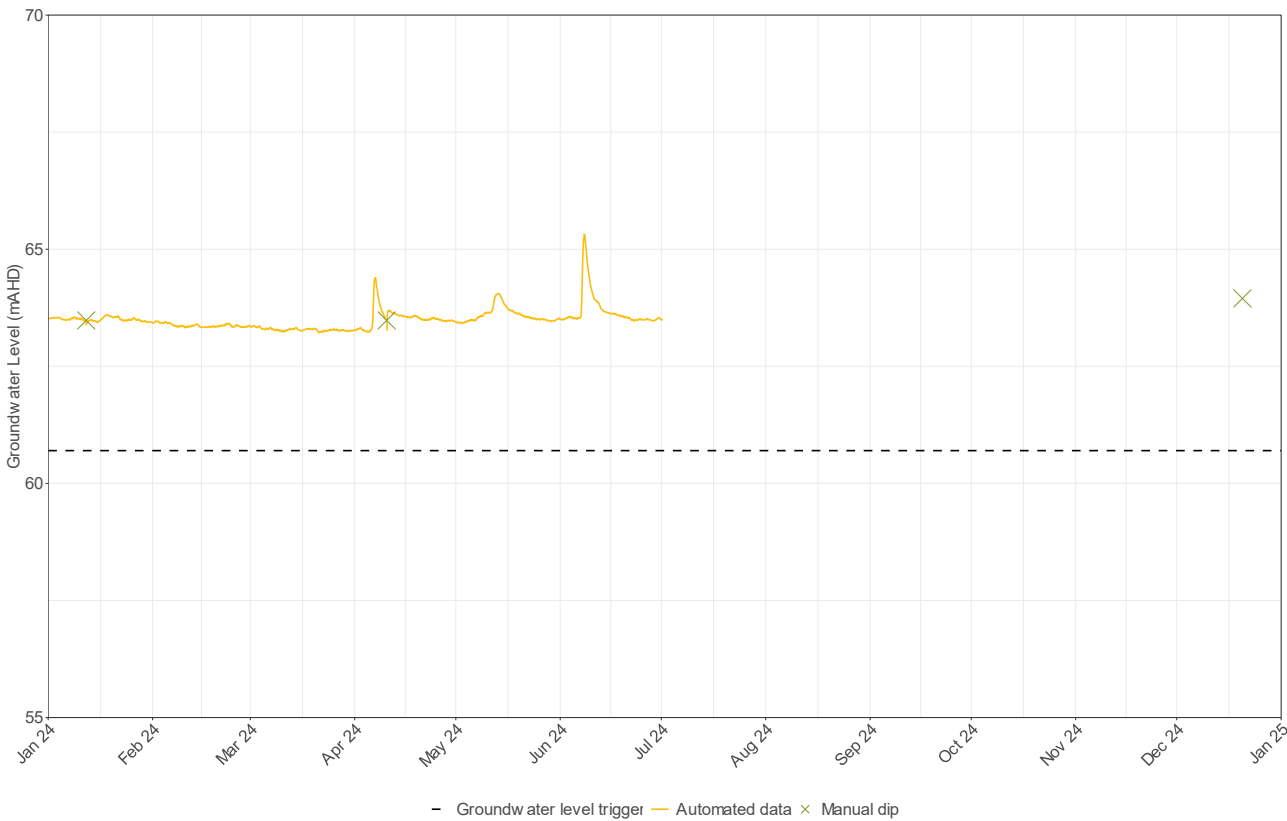


Figure 6 **BH04 groundwater level hydrograph**

Groundwater quality review

Groundwater quality trigger values within the SWMP comprise minimum and maximum values for electrical conductivity and pH. Groundwater quality trigger values were generally based on baseline data acquired before 2023, and the ANZECC (2000) Water Quality Guidelines: 95% protection levels (trigger values) for the protection of slightly disturbed freshwater ecosystems, South-East Australia, lowland river ecosystems.

During the reporting period, no exceedances of electrical conductivity groundwater quality trigger values were recorded. Table 4 presents a summary of electrical conductivity groundwater quality trigger values and monitoring results.

Table 4 Groundwater quality trigger summary – Electrical conductivity

Location	Electrical conductivity (¹µS/cm)				Trigger exceedance
	Monitoring result (10 April 2024)		Trigger value (²SWMP)		
	³Field	⁴Laboratory	Lower limit	Upper limit	
BH01_Shallow	367	326	125	2,500	No
BH01_Deep	542	993	125	3,000	No
BH02	9,115	9,070	125	10,000	No
BH03	1,261	1,210	125	2,500	No
BH04	8,441	8,330	125	12,000	No

Notes: 1. Micro-siemens per centimetres 2. Menangle Sand and Soil Quarry - Soil and Water Management Plan, 9 September 2024
4. Acquired in field using a hand-held water quality meter 5. As provided by the analysing laboratory

During the reporting period, exceedances were recorded below the minimum groundwater quality trigger value for pH at five locations in the monitoring network. Table 5 presents a summary of groundwater quality trigger values for pH and monitoring results.

Table 5 Groundwater quality trigger summary – pH

Location	Potential hydrogen (1pH)				Trigger exceedance
	Monitoring result (10 April 2024)		Trigger value (2SWMP)		
	3Field	4Laboratory	Lower limit	Upper limit	
BH01_Shallow	4.25	4.64	6.5	8.0	Yes
BH01_Deep	4.94	5.49	6.5	8.0	Yes
BH02	5.01	5.48	6.5	8.5	Yes
BH03	4.03	4.60	6.5	8.0	Yes
BH04	5.26	5.70	6.5	8.5	Yes

Notes: 1. pH units 2. Menangle Sand and Soil Quarry - Soil and Water Management Plan, 9 September 2024
4. Acquired in field using a hand-held water quality meter 5. As provided by the analysing laboratory

Minimum groundwater quality trigger exceedances of pH in the monitoring network are not considered resultant of activities associated with the quarry, noting monitoring results prior to the commencement of quarrying also exceeded the low-level groundwater trigger value for pH. As indicated on Figure 7, a downward trending pH is observed across all bores within the monitoring network leading up to, and following, commencement of quarrying.

In accordance with the Trigger Action Response Plan (refer Table 6.6 of the SWMP) groundwater quality will continue to be assessed on an annual basis to determine a casual link (if any) with quarrying operations.

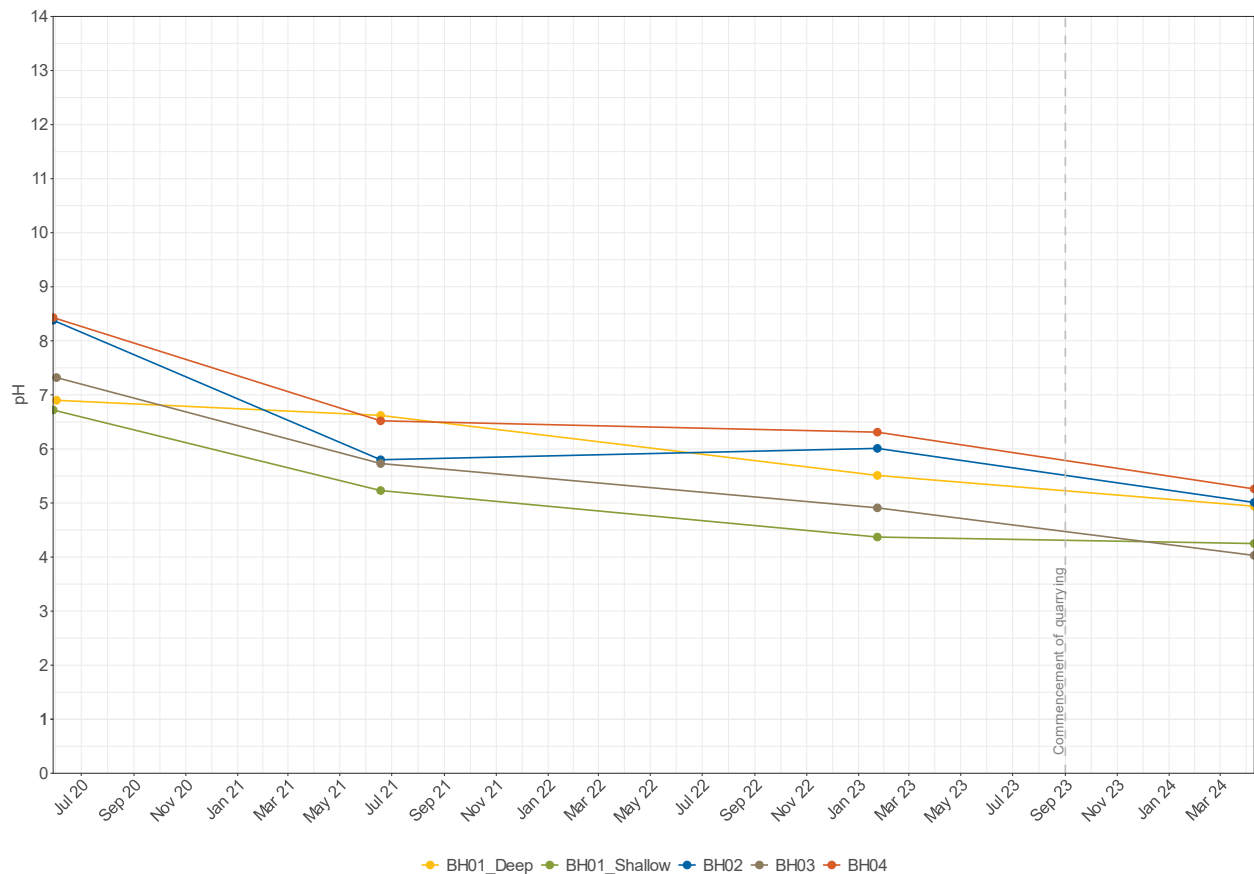


Figure 7 Historical groundwater monitoring pH results at Menangle Quarry

Recommendations

EMM provides the following recommendations:

- Automated pressure transducers are maintained within the groundwater monitoring network, and replaced where required.
- Groundwater quality trigger values for pH are reviewed in the SWMP, ensuring all baseline data (prior to the commencement of quarrying) is considered.
- Groundwater quality sampling is undertaken for the 2025 calendar year.

Conclusion

A groundwater data review was undertaken for the 2024 calendar year. Groundwater level exceedances and groundwater quality exceedances (for electrical conductivity) were not recorded, in accordance with the SWMP. Minimum groundwater quality trigger values (for pH) were exceeded at five bores in the monitoring network, however the exceedances are not considered a result of quarrying activities.

Yours sincerely



Henry Noakes
Associate Hydrogeologist
hnoakes@emmconsulting.com.au



Soil Chemistry Profile Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

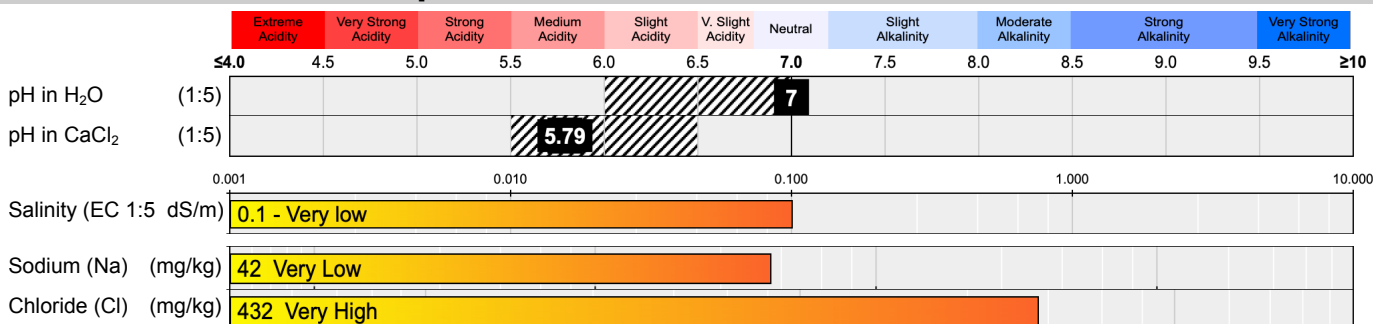
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Client Name: Benedict Industries Pty Ltd	Project Name: Menangle - FSC_Plus	SES L Quote N°:	
Client Contact: Results	Sample Name: Stage 6 Restoration Area PLOT 1	Description: Soil	
Client Order N°:	Test Type: FSC_Plus		
Address: PO Box 431 FRENCHS FOREST NSW 1640			

RECOMMENDATIONS

Analysed by SES L Australia Pty Ltd, NATA #15633

Results Only Requested

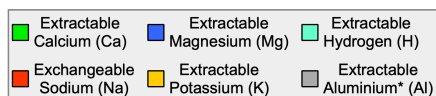
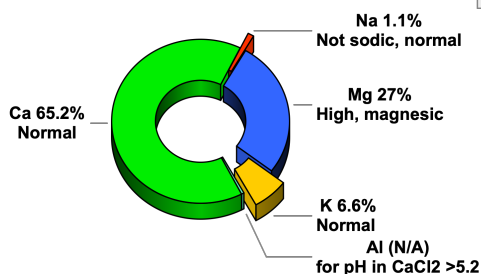
pH and ELECTRICAL CONDUCTIVITY



CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in CaCl₂ ≤ 5.5
Al only determined if pH in CaCl₂ is ≤ 5.2



EFFECTIVE CATION EXCHANGE CAPACITY (eCEC) (cmol(+)/kg)



CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	2.4	3 – 6
Comment: Calcium low		
Mg:K	4	2.6 – 5.0
Comment: Balanced		
K/(Ca+Mg)	0.07	< 0.07
Comment: High		
K:Na	6.1	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.18	1.09	10.7	4.42	-	-

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.
The units of eCEC cmol(+)/kg are the SI unit and are equivalent to meq/100g.

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy



Soil Chemistry Profile Mehlich 3 - Multi-nutrient Extractant

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Em: info@sesl.com.au
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Client Name: Benedict Industries Pty Ltd	Project Name: Menangle - FSC_Plus	SES L Quote N°:	
Client Contact: Results	Sample Name: Stage 6 Restoration Area PLOT 1	Description: Soil	
Client Order N°:	Test Type: FSC_Plus		
Address: PO Box 431 FRENCHS FOREST NSW 1640			

PLANT AVAILABLE NUTRIENTS							
EFFECTIVE AMELIORATION DEPTH (mm): ☉ 100 ○ 150 ○ 200				DESIRED FERTILITY CLASS: ○ Low ☉ Moderate ○ High			
Major Nutrients	Unit	Result	Very Low Low Marginal Adequate High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)	
Nitrate-N (NO ₃)	mg N/kg	<0.05		<0.4	4	3.6	
Phosphorus (P)	mg P/kg	64		8.5	8.4	Drawdown	
Potassium (K)	mg/kg	420		55.9	40.4	Drawdown	
Sulfur (S)	mg S/kg	20		2.7	9	6.3	
Calcium (Ca)	mg/kg	2100		279.3	287.8	8.5	
Magnesium (Mg)	mg/kg	540		71.8	29.9	Drawdown	
Iron (Fe)	mg/kg	430		57.2	73.4	16.2	
Manganese (Mn)	mg/kg	81		10.8	5.9	Drawdown	
Zinc (Zn)	mg/kg	14		1.9	0.7	Drawdown	
Copper (Cu)	mg/kg	3.1		0.4	0.8	0.4	
Boron (B)	mg/kg	0.68		0.1	0.4	0.3	

Explanation of graph ranges:

Very Low

Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90 %.

Low

Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90 %.

Marginal

Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

Adequate

Supply of this nutrient is adequate for the plant, and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30 %.

High

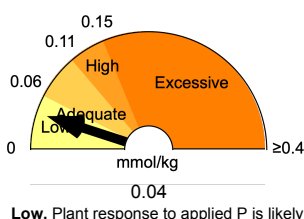
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the **Adequate** band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.

Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed **Adequate**.

* g/sqm measurements are based on soil bulk density of 1.33 tonne/m³ and effective amelioration depth.

Phosphorus Saturation Index



Exchangeable Acidity

Adams-Evans Buffer pH (BpH): -
Sum of Base Cations (cmol(+)/kg): **16.4**
Eff. Cation Exch. Capacity (eCEC): **16.4**
Base Saturation (%): **100**
Exchangeable Acidity (cmol(+)/kg): -
Exchangeable Acidity (%): -

Lime Application Rate (g/sqm)

- to achieve pH 6.0: **0**
- to neutralise Al: -

Calculated Gypsum Application Rate (CGAR)

(g/sqm) to achieve 67.5 % exch. Ca: **42**

The CGAR is corrected for the selected effective amelioration depth (100 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture: Fine Sandy Clay Loam	Munsell Colour: -	Organic Carbon (OC %): Very High - 4.7
Estimated clay content: 20 - 30%	Structure Size: Medium (11 - 25mm)	Organic Matter (OM %): 8
Tactually gravelly: Gravelly	Structural Organisation: Pedal - Weak	Est. Field Capacity (% water): 28
Tactually organic: Not Organic	Structural Unit: Crumb	Est. Permanent Wilting Point (% water): 15
Calculated EC _{SE} (dS/m): 0.9	Potential infiltration rate: Moderate	Est. Plant Available Water (% water): 13
- Non-saline. Salinity effects on plants are mostly negligible.	Est. Permeability Class (mm/hr): 5 - 20	Est. Plant Available Water (mm/m): 130
	Additional comments:	

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy



Soil Chemistry Profile Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

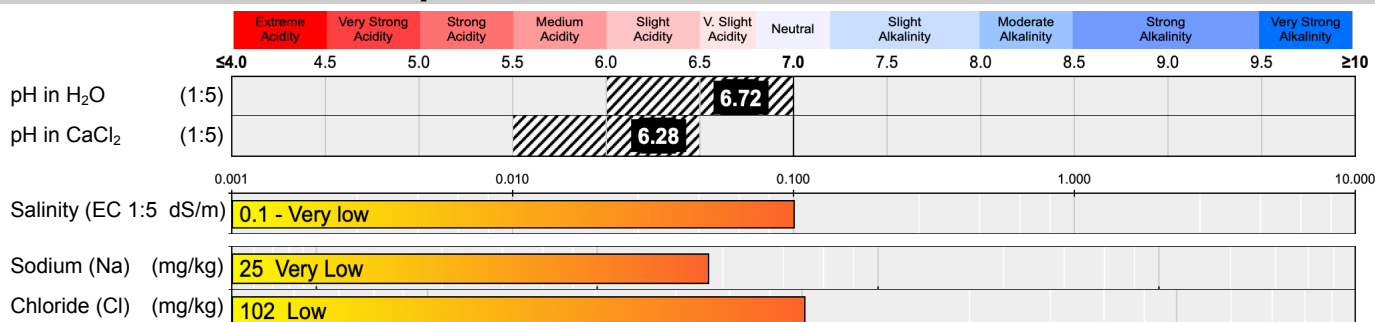
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Client Name: Benedict Industries Pty Ltd	Project Name: Menangle - FSC_Plus	SESL Quote N°:	
Client Contact: Results	Sample Name: Stage 6 Restoration Area PLOT 2	Description: Soil	
Client Order N°:	Test Type: FSC_Plus		
Address: PO Box 431 FRENCHS FOREST NSW 1640			

RECOMMENDATIONS

Analysed by SESL Australia Pty Ltd, NATA #15633

Results Only Requested

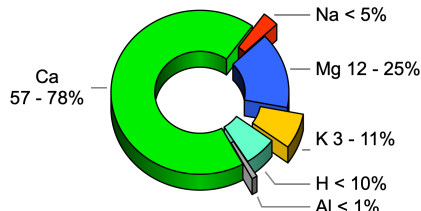
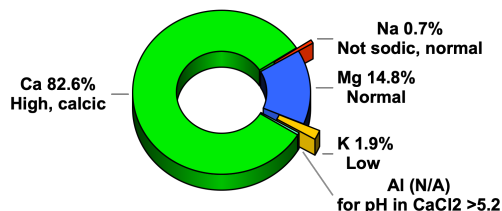
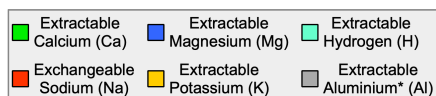
pH and ELECTRICAL CONDUCTIVITY



CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in CaCl₂ ≤ 5.5
Al only determined if pH in CaCl₂ is ≤ 5.2



EFFECTIVE CATION EXCHANGE CAPACITY (eCEC) (cmol(+)/kg)



CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	5.6	3 - 6
Comment: Balanced		
Mg:K	8	2.6 - 5.0
Comment: Potassium low		
K/(Ca+Mg)	0.02	< 0.07
Comment: Acceptable		
K:Na	2.7	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.11	0.3	12.97	2.32	-	-

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.
The units of eCEC cmol(+)/kg are the SI unit and are equivalent to meq/100g.

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy



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Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
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Client Order N°:	Test Type: FSC_Plus		
Address: PO Box 431 FRENCHS FOREST NSW 1640			

PLANT AVAILABLE NUTRIENTS								
EFFECTIVE AMELIORATION DEPTH (mm): ☉ 100 ○ 150 ○ 200			DESIRED FERTILITY CLASS: ○ Low ☉ Moderate ○ High					
Major Nutrients	Unit	Result	Very Low	Low	Marginal	Adequate	High	
Nitrate-N (NO ₃)	mg N/kg	0.36						Result (g/sqm) 0, Desirable (g/sqm) 4, Adjustment (g/sqm) 4
Phosphorus (P)	mg P/kg	14						Result (g/sqm) 1.9, Desirable (g/sqm) 8.4, Adjustment (g/sqm) 6.5
Potassium (K)	mg/kg	120						Result (g/sqm) 16, Desirable (g/sqm) 40.4, Adjustment (g/sqm) 24.4
Sulfur (S)	mg S/kg	20						Result (g/sqm) 2.7, Desirable (g/sqm) 9, Adjustment (g/sqm) 6.3
Calcium (Ca)	mg/kg	2600						Result (g/sqm) 345.8, Desirable (g/sqm) 287.8, Adjustment (g/sqm) Drawdown
Magnesium (Mg)	mg/kg	280						Result (g/sqm) 37.2, Desirable (g/sqm) 29.9, Adjustment (g/sqm) Drawdown
Iron (Fe)	mg/kg	360						Result (g/sqm) 47.9, Desirable (g/sqm) 73.4, Adjustment (g/sqm) 25.5
Manganese (Mn)	mg/kg	98						Result (g/sqm) 13, Desirable (g/sqm) 5.9, Adjustment (g/sqm) Drawdown
Zinc (Zn)	mg/kg	5.5						Result (g/sqm) 0.7, Desirable (g/sqm) 0.7, Adjustment (g/sqm) 0
Copper (Cu)	mg/kg	2.5						Result (g/sqm) 0.3, Desirable (g/sqm) 0.8, Adjustment (g/sqm) 0.5
Boron (B)	mg/kg	0.5						Result (g/sqm) 0.1, Desirable (g/sqm) 0.4, Adjustment (g/sqm) 0.3

Explanation of graph ranges:

Very Low

Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90 %.

Low

Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90 %.

Marginal

Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

Adequate

Supply of this nutrient is adequate for the plant, and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30 %.

High

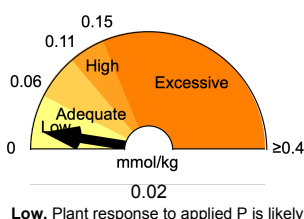
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the Adequate band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.

Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed Adequate.

* g/sqm measurements are based on soil bulk density of 1.33 tonne/m³ and effective amelioration depth.

Phosphorus Saturation Index



Exchangeable Acidity

Adams-Evans Buffer pH (BpH): -
Sum of Base Cations (cmol(+)/kg): **15.7**
Eff. Cation Exch. Capacity (eCEC): **15.7**
Base Saturation (%): **100**
Exchangeable Acidity (cmol(+)/kg): -
Exchangeable Acidity (%): -

Lime Application Rate (g/sqm)

- to achieve pH 6.0: **0**
- to neutralise Al: -

Calculated Gypsum Application Rate (CGAR)

(g/sqm) to achieve 67.5 % exch. Ca: **0**

The CGAR is corrected for the selected effective amelioration depth (100 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture: Sandy Loam	Munsell Colour: -	Organic Carbon (OC %): High - 2.6
Estimated clay content: 10 - 20%	Structure Size: Medium (11 - 25mm)	Organic Matter (OM %): 4.4
Tactually gravelly: Gravelly	Structural Organisation: Pedal - Weak	Est. Field Capacity (% water): 26
Tactually organic: Not Organic	Structural Unit: Crumb	Est. Permanent Wilting Point (% water): 9
Calculated EC _{SE} (dS/m): 1.4	Potential infiltration rate: Rapid	Est. Plant Available Water (% water): 17
- Non-saline. Salinity effects on plants are mostly negligible.	Est. Permeability Class (mm/hr): >120	Est. Plant Available Water (mm/m): 170
	Additional comments:	

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy



Soil Chemistry Profile Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
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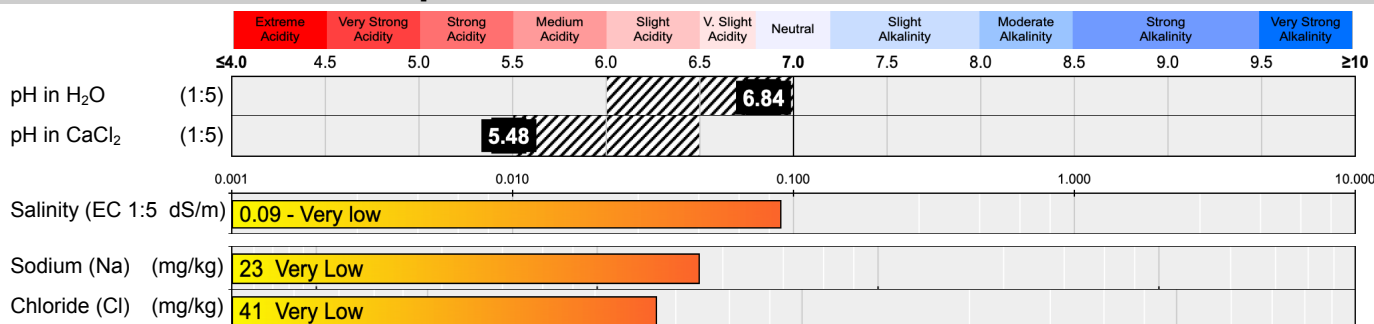
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Client Name: Benedict Industries Pty Ltd	Project Name: Menangle - FSC_Plus	SES L Quote N°:	
Client Contact: Results	Sample Name: Stage 7 Restoration Area PLOT 1	Description: Soil	
Client Order N°:	Test Type: FSC_Plus		
Address: PO Box 431 FRENCHS FOREST NSW 1640			

RECOMMENDATIONS

Analysed by SES L Australia Pty Ltd, NATA #15633

Results Only Requested

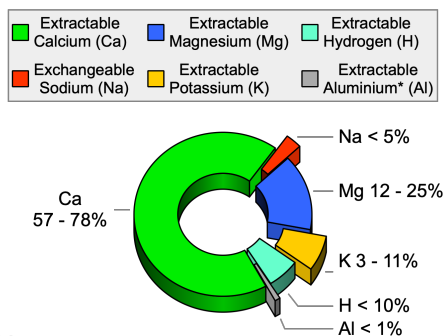
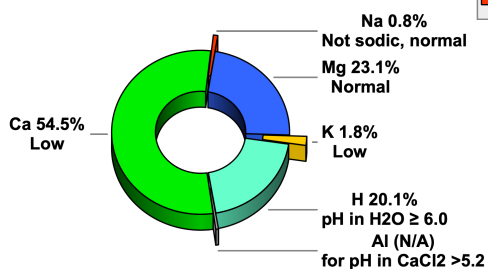
pH and ELECTRICAL CONDUCTIVITY



CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in CaCl₂ ≤ 5.5
Al only determined if pH in CaCl₂ is ≤ 5.2



CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	2.4	3 – 6
Comment: Calcium low		
Mg:K	10	2.6 – 5.0
Comment: Potassium low		
K/(Ca+Mg)	0.02	< 0.07
Comment: Acceptable		
K:Na	2.2	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.1	0.22	6.6	2.79	2.43	-

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.
The units of eCEC cmol(+)/kg are the SI unit and are equivalent to meq/100g.

EFFECTIVE CATION EXCHANGE CAPACITY (eCEC) (cmol(+)/kg)



Consultant:
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Authorised Signatory:
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Client Order N°:	Test Type: FSC_Plus		
Address: PO Box 431 FRENCHS FOREST NSW 1640			

PLANT AVAILABLE NUTRIENTS							
EFFECTIVE AMELIORATION DEPTH (mm): ☉ 100 ○ 150 ○ 200				DESIRED FERTILITY CLASS: ○ Low ☉ Moderate ○ High			
Major Nutrients	Unit	Result	Very Low Low Marginal Adequate High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)	
Nitrate-N (NO ₃)	mg N/kg	11		1.5	4	2.5	
Phosphorus (P)	mg P/kg	8.3		1.1	8.4	7.3	
Potassium (K)	mg/kg	85		11.3	34.8	23.5	
Sulfur (S)	mg S/kg	30		4	9	5	
Calcium (Ca)	mg/kg	1300		172.9	248	75.1	
Magnesium (Mg)	mg/kg	340		45.2	25.8	Drawdown	
Iron (Fe)	mg/kg	380		50.5	73.4	22.9	
Manganese (Mn)	mg/kg	50		6.7	5.9	Drawdown	
Zinc (Zn)	mg/kg	6.6		0.9	0.7	Drawdown	
Copper (Cu)	mg/kg	1.5		0.2	0.8	0.6	
Boron (B)	mg/kg	0.19		0	0.4	0.4	

Explanation of graph ranges:

Very Low

Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90 %.

Low

Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90 %.

Marginal

Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

Adequate

Supply of this nutrient is adequate for the plant, and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30 %.

High

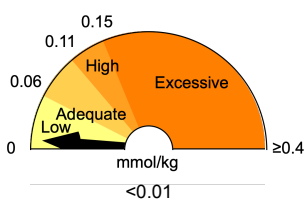
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the Adequate band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.

Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed Adequate.

* g/sqm measurements are based on soil bulk density of 1.33 tonne/m³ and effective amelioration depth.

Phosphorus Saturation Index



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH): **7.6**
Sum of Base Cations (cmol(+)/kg): **9.7**
Eff. Cation Exch. Capacity (eCEC): **12.1**
Base Saturation (%): **80.17**
Exchangeable Acidity (cmol(+)/kg): **-**
Exchangeable Acidity (%): **-**

Lime Application Rate (g/sqm)

– to achieve pH 6.0: **0**
– to neutralise Al: **-**

Calculated Gypsum Application Rate (CGAR)

(g/sqm) to achieve 67.5 % exch. Ca: **179**

The CGAR is corrected for the selected effective amelioration depth (100 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture: Loamy Sand	Munsell Colour: -	Organic Carbon (OC %): High - 2.7
Estimated clay content: 5 - 10%	Structure Size: Fine (1 - 10mm)	Organic Matter (OM %): 4.6
Tactually gravelly: Not gravelly	Structural Organisation: Pedal - Weak	Est. Field Capacity (% water): 18
Tactually organic: Not Organic	Structural Unit: Crumb	Est. Permanent Wilting Point (% water): 7
Calculated EC _{SE} (dS/m): 2.1	Potential infiltration rate: Very Rapid	Est. Plant Available Water (% water): 11
– Slightly saline. Growth on sensitive plant species is affected.	Est. Permeability Class (mm/hr): >120	Est. Plant Available Water (mm/m): 110
	Additional comments:	

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy



Soil Chemistry Profile Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

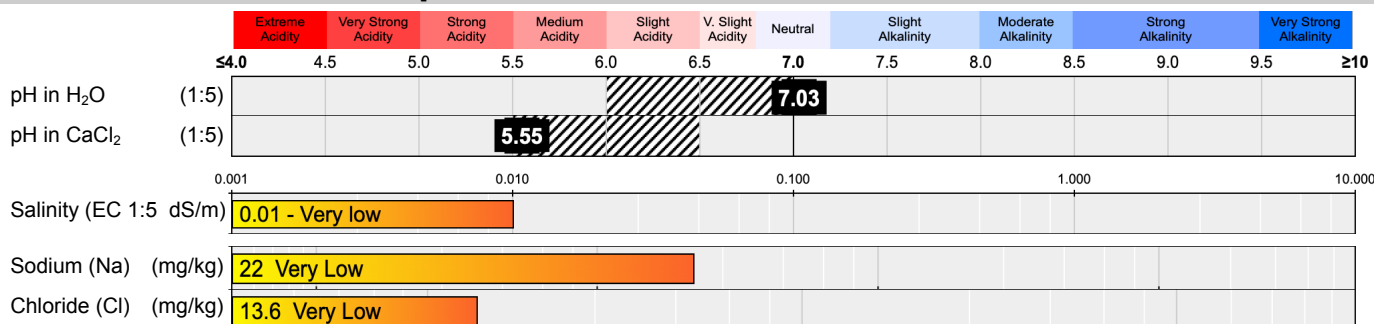
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Client Name: Benedict Industries Pty Ltd	Project Name: Menangle - FSC_Plus	SES L Quote N°:	
Client Contact: Results	Sample Name: Stage 7 Restoration Area PLOT 2	Description: Soil	
Client Order N°:	Test Type: FSC_Plus		
Address: PO Box 431 FRENCHS FOREST NSW 1640			

RECOMMENDATIONS

Analysed by SES L Australia Pty Ltd, NATA #15633

Results Only Requested

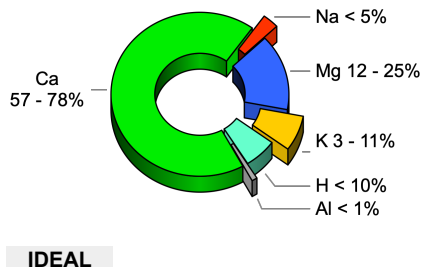
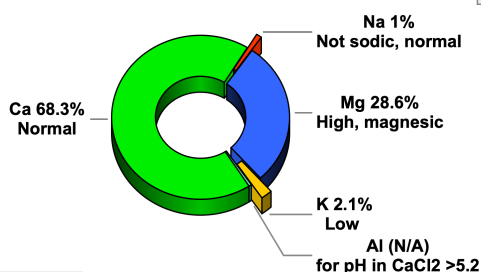
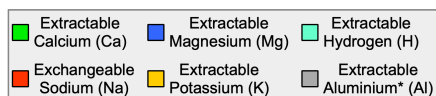
pH and ELECTRICAL CONDUCTIVITY



CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in CaCl₂ ≤ 5.5
Al only determined if pH in CaCl₂ is ≤ 5.2



EFFECTIVE CATION EXCHANGE CAPACITY (eCEC) (cmol(+)/kg)



CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	2.4	3 - 6
Comment: Calcium low		
Mg:K	10	2.6 - 5.0
Comment: Potassium low		
K/(Ca+Mg)	0.02	< 0.07
Comment: Acceptable		
K:Na	2	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.1	0.2	6.56	2.75	-	-

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.
The units of eCEC cmol(+)/kg are the SI unit and are equivalent to meq/100g.

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy



Soil Chemistry Profile Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163	Sample N°: 4	Date Report Generated: 11/03/2024	Report Status: Final
Client Name: Benedict Industries Pty Ltd	Project Name: Menangle - FSC_Plus	SES L Quote N°:	
Client Contact: Results	Sample Name: Stage 7 Restoration Area PLOT 2	Description: Soil	
Client Order N°:	Test Type: FSC_Plus		
Address: PO Box 431 FRENCHS FOREST NSW 1640			

PLANT AVAILABLE NUTRIENTS							
EFFECTIVE AMELIORATION DEPTH (mm): ☉ 100 ○ 150 ○ 200				DESIRED FERTILITY CLASS: ○ Low ☉ Moderate ○ High			
Major Nutrients	Unit	Result	Very Low Low Marginal Adequate High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)	
Nitrate-N (NO ₃)	mg N/kg	1.8		0.2	4	3.8	
Phosphorus (P)	mg P/kg	7.8		1	8.4	7.4	
Potassium (K)	mg/kg	77		10.2	29.3	19.1	
Sulfur (S)	mg S/kg	33		4.4	9	4.6	
Calcium (Ca)	mg/kg	1300		172.9	208.3	35.4	
Magnesium (Mg)	mg/kg	330		43.9	21.7	Drawdown	
Iron (Fe)	mg/kg	370		49.2	73.4	24.2	
Manganese (Mn)	mg/kg	50		6.7	5.9	Drawdown	
Zinc (Zn)	mg/kg	6.6		0.9	0.7	Drawdown	
Copper (Cu)	mg/kg	1.5		0.2	0.8	0.6	
Boron (B)	mg/kg	0.12		0	0.4	0.4	

Explanation of graph ranges:

Very Low

Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90 %.

Low

Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90 %.

Marginal

Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

Adequate

Supply of this nutrient is adequate for the plant, and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30 %.

High

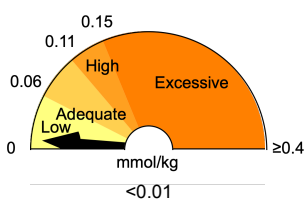
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the Adequate band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.

Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed Adequate.

* g/sqm measurements are based on soil bulk density of 1.33 tonne/m³ and effective amelioration depth.

Phosphorus Saturation Index



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH): -
Sum of Base Cations (cmol(+)/kg): **9.6**
Eff. Cation Exch. Capacity (eCEC): **9.6**
Base Saturation (%): **100**
Exchangeable Acidity (cmol(+)/kg): -
Exchangeable Acidity (%): -

Lime Application Rate (g/sqm)

- to achieve pH 6.0: **0**
- to neutralise Al: -

Calculated Gypsum Application Rate (CGAR)

(g/sqm) to achieve 67.5 % exch. Ca: **0**

The CGAR is corrected for the selected effective amelioration depth (100 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture: Sand	Munsell Colour: -	Organic Carbon (OC %): Low - 0.7
Estimated clay content: < 5%	Structure Size: Fine (1 - 10mm)	Organic Matter (OM %): 1.2
Tactually gravelly: Not gravelly	Structural Organisation: Apedal - Single	Est. Field Capacity (% water): 8 - 14
Tactually organic: Not Organic	Structural Unit: No Structure	Est. Permanent Wilting Point (% water): 4
Calculated EC _{SE} (dS/m): 0.2	Potential infiltration rate: Very Rapid	Est. Plant Available Water (% water): 4 - 10
- Non-saline. Salinity effects on plants are mostly negligible.	Est. Permeability Class (mm/hr): >120	Est. Plant Available Water (mm/m): 40 - 100
	Additional comments:	

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy



Soil Chemistry Profile Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

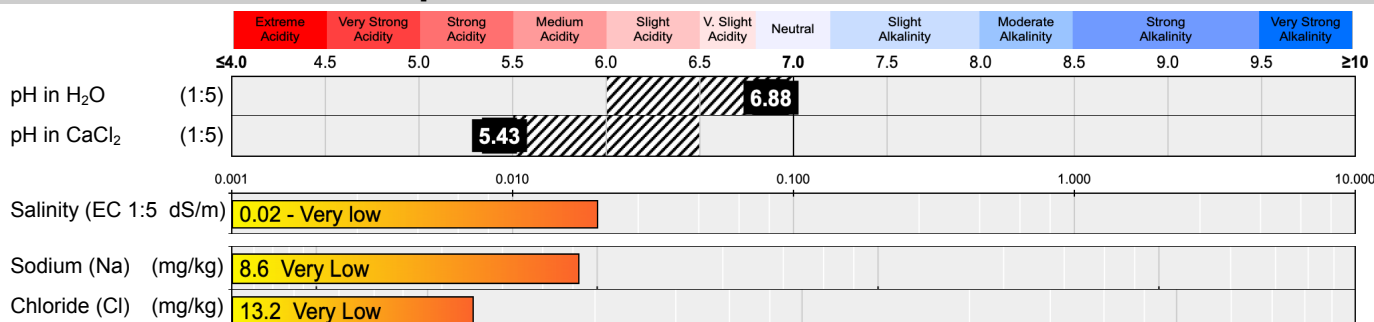
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Client Name: Benedict Industries Pty Ltd	Project Name: Menangle - FSC_Plus	SES L Quote N°:	
Client Contact: Results	Sample Name: Stage 7 Restoration Area PLOT 3	Description: Soil	
Client Order N°:	Test Type: FSC_Plus		
Address: PO Box 431 FRENCHS FOREST NSW 1640			

RECOMMENDATIONS

Analysed by SES L Australia Pty Ltd, NATA #15633

Results Only Requested

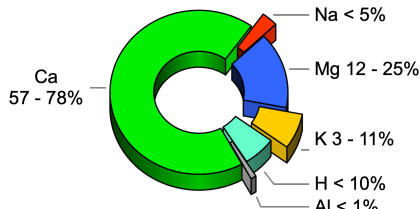
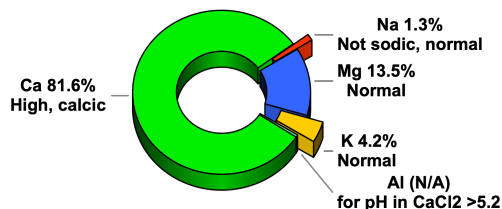
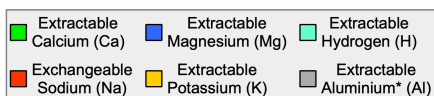
pH and ELECTRICAL CONDUCTIVITY



CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in CaCl₂ ≤ 5.5
Al only determined if pH in CaCl₂ is ≤ 5.2



EFFECTIVE CATION EXCHANGE CAPACITY (eCEC) (cmol(+)/kg)



CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	6	3 - 6
Comment:	Balanced	
Mg:K	3	2.6 - 5.0
Comment:	Balanced	
K/(Ca+Mg)	0.04	< 0.07
Comment:	Acceptable	
K:Na	3.3	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.04	0.13	2.53	0.42	0	-

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.
The units of eCEC cmol(+)/kg are the SI unit and are equivalent to meq/100g.

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy



Soil Chemistry Profile Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163	Sample N°: 5	Date Report Generated: 11/03/2024	Report Status: Final
Client Name: Benedict Industries Pty Ltd	Project Name: Menangle - FSC_Plus	SES L Quote N°:	
Client Contact: Results	Sample Name: Stage 7 Restoration Area PLOT 3	Description: Soil	
Client Order N°:	Test Type: FSC_Plus		
Address: PO Box 431 FRENCHS FOREST NSW 1640			

PLANT AVAILABLE NUTRIENTS							
EFFECTIVE AMELIORATION DEPTH (mm): ☉ 100 ○ 150 ○ 200				DESIRED FERTILITY CLASS: ○ Low ☉ Moderate ○ High			
Major Nutrients	Unit	Result	Very Low Low Marginal Adequate High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)	
Nitrate-N (NO ₃)	mg N/kg	1.3		0.2	4	3.8	
Phosphorus (P)	mg P/kg	6.5		0.9	8.4	7.5	
Potassium (K)	mg/kg	52		6.9	23.7	16.8	
Sulfur (S)	mg S/kg	15		2	9	7	
Calcium (Ca)	mg/kg	510		67.8	168.5	100.7	
Magnesium (Mg)	mg/kg	51		6.8	17.8	11	
Iron (Fe)	mg/kg	130		17.3	73.4	56.1	
Manganese (Mn)	mg/kg	16		2.1	5.9	3.8	
Zinc (Zn)	mg/kg	2.5		0.3	0.7	0.4	
Copper (Cu)	mg/kg	1.3		0.2	0.8	0.6	
Boron (B)	mg/kg	0.19		0	0.4	0.4	

Explanation of graph ranges:

Very Low

Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90 %.

Low

Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90 %.

Marginal

Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

Adequate

Supply of this nutrient is adequate for the plant, and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30 %.

High

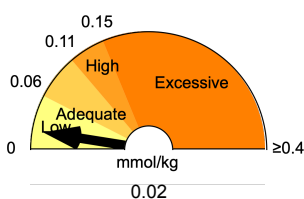
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the Adequate band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.

Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed Adequate.

* g/sqm measurements are based on soil bulk density of 1.33 tonne/m³ and effective amelioration depth.

Phosphorus Saturation Index



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH): **8.1**
Sum of Base Cations (cmol(+)/kg): **3.1**
Eff. Cation Exch. Capacity (eCEC): **3.1**
Base Saturation (%): **100**
Exchangeable Acidity (cmol(+)/kg): **-**
Exchangeable Acidity (%): **-**

Lime Application Rate (g/sqm)

– to achieve pH 6.0: **0**
– to neutralise Al: **-**

Calculated Gypsum Application Rate (CGAR)

(g/sqm) to achieve 67.5 % exch. Ca: **0**

The CGAR is corrected for the selected effective amelioration depth (100 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION			
Texture: Sand	Munsell Colour: -	Organic Carbon (OC %): Very low - 0.5	
Estimated clay content: < 5%	Structure Size: Fine (1 - 10mm)	Organic Matter (OM %): 0.8	
Tactually gravelly: Not gravelly	Structural Organisation: Apedal - Single	Est. Field Capacity (% water): 8 - 14	
Tactually organic: Not Organic	Structural Unit: No Structure	Est. Permanent Wilting Point (% water): 4	
Calculated EC _{SE} (dS/m): 0.5	Potential infiltration rate: Very Rapid	Est. Plant Available Water (% water): 4 - 10	
– Non-saline. Salinity effects on plants are mostly negligible.	Est. Permeability Class (mm/hr): >120	Est. Plant Available Water (mm/m): 40 - 100	
	Additional comments:		

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy



Soil Chemistry Profile Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

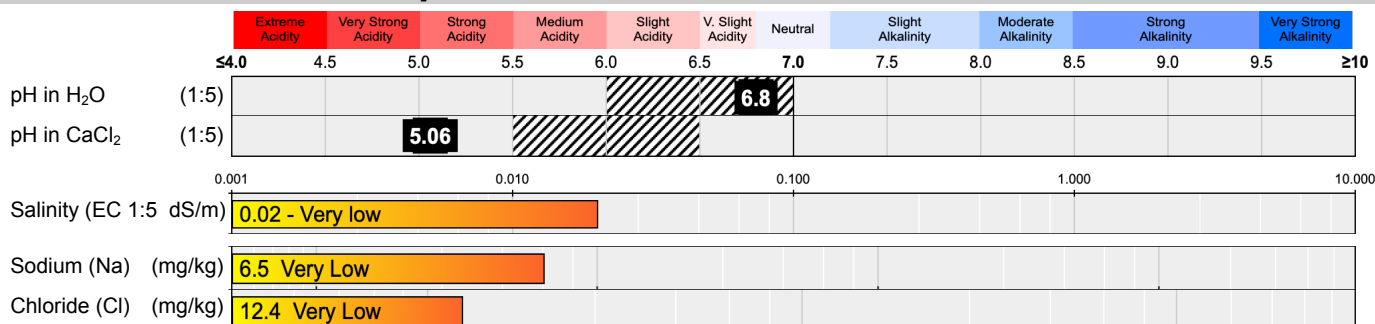
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Client Name: Benedict Industries Pty Ltd	Project Name: Menangle - FSC_Plus	SESL Quote N°:	
Client Contact: Results	Sample Name: Stage 7 Restoration Area PLOT 4	Description: Soil	
Client Order N°:	Test Type: FSC_Plus		
Address: PO Box 431 FRENCHS FOREST NSW 1640			

RECOMMENDATIONS

Analysed by SESL Australia Pty Ltd, NATA #15633

Results Only Requested

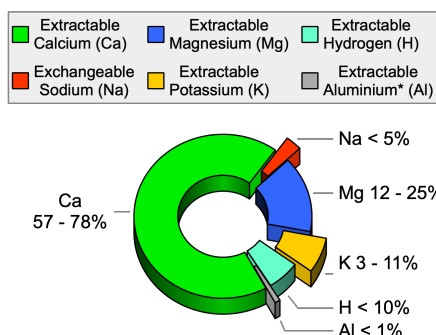
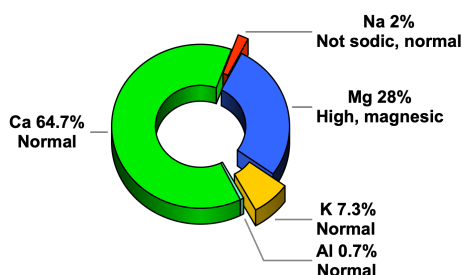
pH and ELECTRICAL CONDUCTIVITY



CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in CaCl₂ ≤ 5.5
Al only determined if pH in CaCl₂ is ≤ 5.2



EFFECTIVE CATION EXCHANGE CAPACITY (eCEC) (cmol(+)/kg)



CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	2.3	3 – 6
Comment: Calcium low		
Mg:K	4	2.6 – 5.0
Comment: Balanced		
K/(Ca+Mg)	0.08	< 0.07
Comment: High		
K:Na	3.7	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.03	0.11	0.97	0.42	0	0.01

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.
The units of eCEC cmol(+)/kg are the SI unit and are equivalent to meq/100g.

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy



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Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
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Batch N°: 67163	Sample N°: 6	Date Report Generated: 11/03/2024	Report Status: Final
Client Name: Benedict Industries Pty Ltd	Project Name: Menangle - FSC_Plus	SES L Quote N°:	
Client Contact: Results	Sample Name: Stage 7 Restoration Area PLOT 4	Description: Soil	
Client Order N°:	Test Type: FSC_Plus		
Address: PO Box 431 FRENCHS FOREST NSW 1640			

PLANT AVAILABLE NUTRIENTS							
EFFECTIVE AMELIORATION DEPTH (mm): ☉ 100 ○ 150 ○ 200				DESIRED FERTILITY CLASS: ○ Low ☉ Moderate ○ High			
Major Nutrients	Unit	Result	Very Low Low Marginal Adequate High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)	
Nitrate-N (NO ₃)	mg N/kg	2.2		0.3	4	3.7	
Phosphorus (P)	mg P/kg	5.7		0.8	8.4	7.6	
Potassium (K)	mg/kg	43		5.7	23.7	18	
Sulfur (S)	mg S/kg	9.4		1.3	9	7.7	
Calcium (Ca)	mg/kg	190		25.3	168.5	143.2	
Magnesium (Mg)	mg/kg	51		6.8	17.8	11	
Iron (Fe)	mg/kg	110		14.6	73.4	58.8	
Manganese (Mn)	mg/kg	12		1.6	5.9	4.3	
Zinc (Zn)	mg/kg	1.5		0.2	0.7	0.5	
Copper (Cu)	mg/kg	<0.64		0.1	0.8	0.7	
Boron (B)	mg/kg	<0.1		0	0.4	0.4	

Explanation of graph ranges:

Very Low

Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90 %.

Low

Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90 %.

Marginal

Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

Adequate

Supply of this nutrient is adequate for the plant, and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30 %.

High

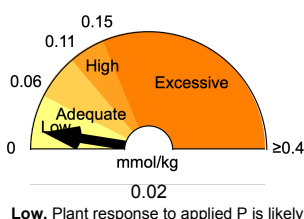
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the Adequate band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.

Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed Adequate.

* g/sqm measurements are based on soil bulk density of 1.33 tonne/m³ and effective amelioration depth.

Phosphorus Saturation Index



Exchangeable Acidity

Adams-Evans Buffer pH (BpH): **8.1**
Sum of Base Cations (cmol(+)/kg): **1.5**
Eff. Cation Exch. Capacity (eCEC): **1.5**
Base Saturation (%): **100**
Exchangeable Acidity (cmol(+)/kg): **-**
Exchangeable Acidity (%): **-**

Lime Application Rate (g/sqm)

– to achieve pH 6.0: **0**
– to neutralise Al: **1**

Calculated Gypsum Application Rate (CGAR)

(g/sqm) to achieve 67.5 % exch. Ca: **5**

The CGAR is corrected for the selected effective amelioration depth (100 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture: Sand	Munsell Colour: -	Organic Carbon (OC %): Very low - 0.5
Estimated clay content: < 5%	Structure Size: Fine (1 - 10mm)	Organic Matter (OM %): 0.8
Tactually gravelly: Not gravelly	Structural Organisation: Apedal - Single	Est. Field Capacity (% water): 8 - 14
Tactually organic: Not Organic	Structural Unit: No Structure	Est. Permanent Wilting Point (% water): 4
Calculated EC _{SE} (dS/m): 0.5	Potential infiltration rate: Very Rapid	Est. Plant Available Water (% water): 4 - 10
– Non-saline. Salinity effects on plants are mostly negligible.	Est. Permeability Class (mm/hr): >120	Est. Plant Available Water (mm/m): 40 - 100
	Additional comments:	

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy



Soil Chemistry Profile Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
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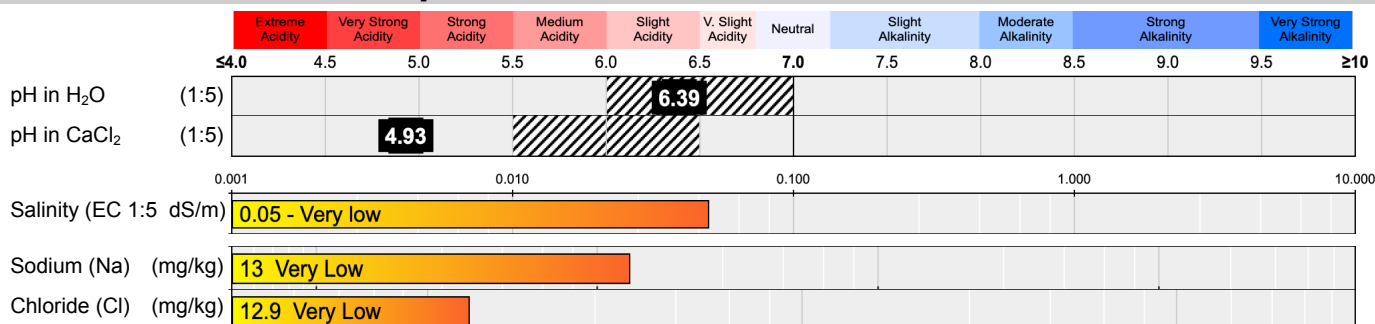
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Client Name: Benedict Industries Pty Ltd	Project Name: Menangle - FSC_Plus	SES L Quote N°:	
Client Contact: Results	Sample Name: Stage 7 Restoration Area PLOT 5	Description: Soil	
Client Order N°:	Test Type: FSC_Plus		
Address: PO Box 431 FRENCHS FOREST NSW 1640			

RECOMMENDATIONS

Analysed by SES L Australia Pty Ltd, NATA #15633

Results Only Requested

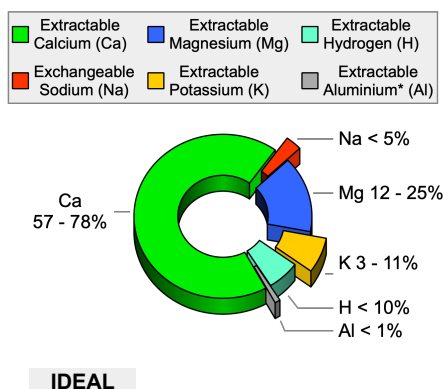
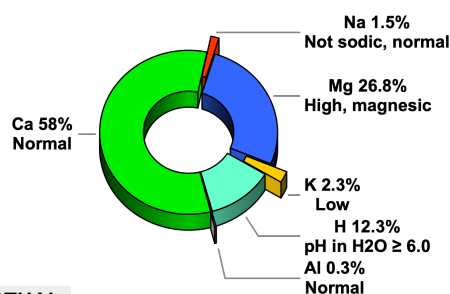
pH and ELECTRICAL CONDUCTIVITY



CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in CaCl₂ ≤ 5.5
Al only determined if pH in CaCl₂ is ≤ 5.2



EFFECTIVE CATION EXCHANGE CAPACITY (eCEC) (cmol(+)/kg)



CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	2.2	3 – 6
Comment: Calcium low		
Mg:K	10	2.6 – 5.0
Comment: Potassium low		
K/(Ca+Mg)	0.03	< 0.07
Comment: Acceptable		
K:Na	1.5	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.06	0.09	2.32	1.07	0.49	0.01

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.
The units of eCEC cmol(+)/kg are the SI unit and are equivalent to meq/100g.

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy



Soil Chemistry Profile Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163	Sample N°: 7	Date Report Generated: 11/03/2024	Report Status: Final
Client Name: Benedict Industries Pty Ltd	Project Name: Menangle - FSC_Plus	SES L Quote N°:	
Client Contact: Results	Sample Name: Stage 7 Restoration Area PLOT 5	Description: Soil	
Client Order N°:	Test Type: FSC_Plus		
Address: PO Box 431 FRENCHS FOREST NSW 1640			

PLANT AVAILABLE NUTRIENTS							
EFFECTIVE AMELIORATION DEPTH (mm): ☉ 100 ○ 150 ○ 200				DESIRED FERTILITY CLASS: ○ Low ☉ Moderate ○ High			
Major Nutrients	Unit	Result	Very Low Low Marginal Adequate High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)	
Nitrate-N (NO ₃)	mg N/kg	9.1		1.2	4	2.8	
Phosphorus (P)	mg P/kg	6.7		0.9	8.4	7.5	
Potassium (K)	mg/kg	36		4.8	23.7	18.9	
Sulfur (S)	mg S/kg	16		2.1	9	6.9	
Calcium (Ca)	mg/kg	460		61.2	168.5	107.3	
Magnesium (Mg)	mg/kg	130		17.3	17.8	0.5	
Iron (Fe)	mg/kg	220		29.3	73.4	44.1	
Manganese (Mn)	mg/kg	22		2.9	5.9	3	
Zinc (Zn)	mg/kg	2.6		0.3	0.7	0.4	
Copper (Cu)	mg/kg	<0.64		0.1	0.8	0.7	
Boron (B)	mg/kg	<0.1		0	0.4	0.4	

Explanation of graph ranges:

Very Low

Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90 %.

Low

Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90 %.

Marginal

Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

Adequate

Supply of this nutrient is adequate for the plant, and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30 %.

High

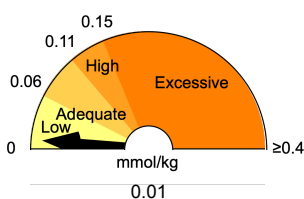
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the Adequate band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.

Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed Adequate.

* g/sqm measurements are based on soil bulk density of 1.33 tonne/m³ and effective amelioration depth.

Phosphorus Saturation Index



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH): **7.9**
Sum of Base Cations (cmol(+)/kg): **3.5**
Eff. Cation Exch. Capacity (eCEC): **4**
Base Saturation (%): **87.5**
Exchangeable Acidity (cmol(+)/kg): **-**
Exchangeable Acidity (%): **-**

Lime Application Rate (g/sqm)

– to achieve pH 6.0: **0**
– to neutralise Al: **1**

Calculated Gypsum Application Rate (CGAR) (g/sqm) to achieve 67.5 % exch. Ca: **43**

The CGAR is corrected for the selected effective amelioration depth (100 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture: Sand	Munsell Colour: -	Organic Carbon (OC %): Moderate - 1.5
Estimated clay content: < 5%	Structure Size: Fine (1 - 10mm)	Organic Matter (OM %): 2.5
Tactually gravelly: Not gravelly	Structural Organisation: Pedal - Weak	Est. Field Capacity (% water): 8 - 14
Tactually organic: Not Organic	Structural Unit: Crumb	Est. Permanent Wilting Point (% water): 4
Calculated EC _{SE} (dS/m): 1.2	Potential infiltration rate: Very Rapid	Est. Plant Available Water (% water): 4 - 10
– Non-saline. Salinity effects on plants are mostly negligible.	Est. Permeability Class (mm/hr): >120	Est. Plant Available Water (mm/m): 40 - 100
	Additional comments:	

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy



Soil Chemistry Profile Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

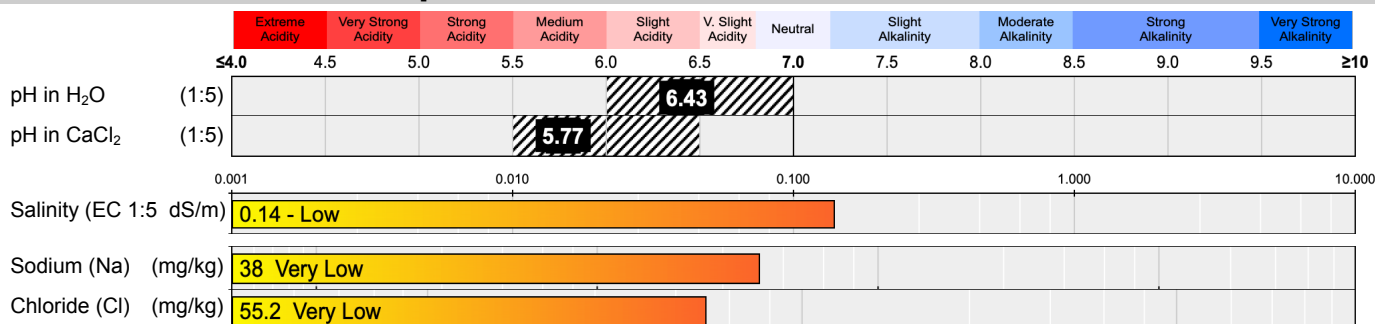
Batch N°: 67163	Sample N°: 8	Date Report Generated: 11/03/2024	Report Status: Final
Client Name: Benedict Industries Pty Ltd	Project Name: Menangle - FSC_Plus	SES L Quote N°:	
Client Contact: Results	Sample Name: Stage 8 Restoration Area PLOT 1	Description: Soil	
Client Order N°:	Test Type: FSC_Plus		
Address: PO Box 431 FRENCHS FOREST NSW 1640			

RECOMMENDATIONS

Analysed by SES L Australia Pty Ltd, NATA #15633

Results Only Requested

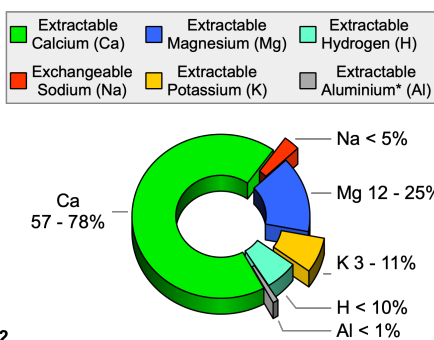
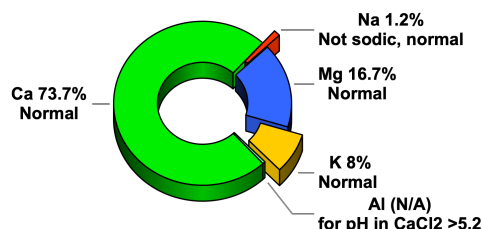
pH and ELECTRICAL CONDUCTIVITY



CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in CaCl₂ ≤ 5.5
Al only determined if pH in CaCl₂ is ≤ 5.2



EFFECTIVE CATION EXCHANGE CAPACITY (eCEC) (cmol(+)/kg)



CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	4.4	3 – 6
Comment: Balanced		
Mg:K	2	2.6 – 5.0
Comment: Magnesium low		
K/(Ca+Mg)	0.09	< 0.07
Comment: High		
K:Na	6.5	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.17	1.11	10.17	2.3	-	-

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.
The units of eCEC cmol(+)/kg are the SI unit and are equivalent to meq/100g.

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy



Soil Chemistry Profile Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163	Sample N°: 8	Date Report Generated: 11/03/2024	Report Status: Final
Client Name: Benedict Industries Pty Ltd	Project Name: Menangle - FSC_Plus	SES L Quote N°:	
Client Contact: Results	Sample Name: Stage 8 Restoration Area PLOT 1	Description: Soil	
Client Order N°:	Test Type: FSC_Plus		
Address: PO Box 431 FRENCHS FOREST NSW 1640			

PLANT AVAILABLE NUTRIENTS							
EFFECTIVE AMELIORATION DEPTH (mm): ☉ 100 ○ 150 ○ 200				DESIRED FERTILITY CLASS: ○ Low ☉ Moderate ○ High			
Major Nutrients	Unit	Result	Very Low Low Marginal Adequate High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)	
Nitrate-N (NO ₃)	mg N/kg	14		1.9	4	2.1	
Phosphorus (P)	mg P/kg	24		3.2	8.4	5.2	
Potassium (K)	mg/kg	430		57.2	34.8	Drawdown	
Sulfur (S)	mg S/kg	30		4	9	5	
Calcium (Ca)	mg/kg	2000		266	248	Drawdown	
Magnesium (Mg)	mg/kg	280		37.2	25.8	Drawdown	
Iron (Fe)	mg/kg	310		41.2	73.4	32.2	
Manganese (Mn)	mg/kg	120		16	5.9	Drawdown	
Zinc (Zn)	mg/kg	5.2		0.7	0.7	0	
Copper (Cu)	mg/kg	2.9		0.4	0.8	0.4	
Boron (B)	mg/kg	0.48		0.1	0.4	0.3	

Explanation of graph ranges:

Very Low

Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90 %.

Low

Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90 %.

Marginal

Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

Adequate

Supply of this nutrient is adequate for the plant, and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30 %.

High

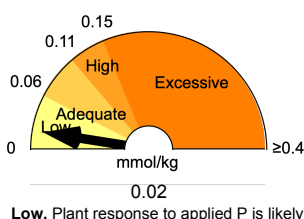
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the **Adequate** band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.

Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed **Adequate**.

* g/sqm measurements are based on soil bulk density of 1.33 tonne/m³ and effective amelioration depth.

Phosphorus Saturation Index



Exchangeable Acidity

Adams-Evans Buffer pH (BpH): -
Sum of Base Cations (cmol(+)/kg): **13.8**
Eff. Cation Exch. Capacity (eCEC): **13.8**
Base Saturation (%): **100**
Exchangeable Acidity (cmol(+)/kg): -
Exchangeable Acidity (%): -

Lime Application Rate (g/sqm)

- to achieve pH 6.0: **0**
- to neutralise Al: -

Calculated Gypsum Application Rate (CGAR) (g/sqm) to achieve 67.5 % exch. Ca: **0**

The CGAR is corrected for the selected effective amelioration depth (100 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture: Sandy Loam	Munsell Colour: -	Organic Carbon (OC %): High - 2.3
Estimated clay content: 10 - 20%	Structure Size: Medium (11 - 25mm)	Organic Matter (OM %): 3.9
Tactually gravelly: Gravelly	Structural Organisation: Pedal - Weak	Est. Field Capacity (% water): 26
Tactually organic: Not Organic	Structural Unit: Crumb	Est. Permanent Wilting Point (% water): 9
Calculated EC _{SE} (dS/m): 2	Potential infiltration rate: Rapid	Est. Plant Available Water (% water): 17
- Slightly saline. Growth on sensitive plant species is affected.	Est. Permeability Class (mm/hr): >120	Est. Plant Available Water (mm/m): 170
	Additional comments:	

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy



Soil Chemistry Profile Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

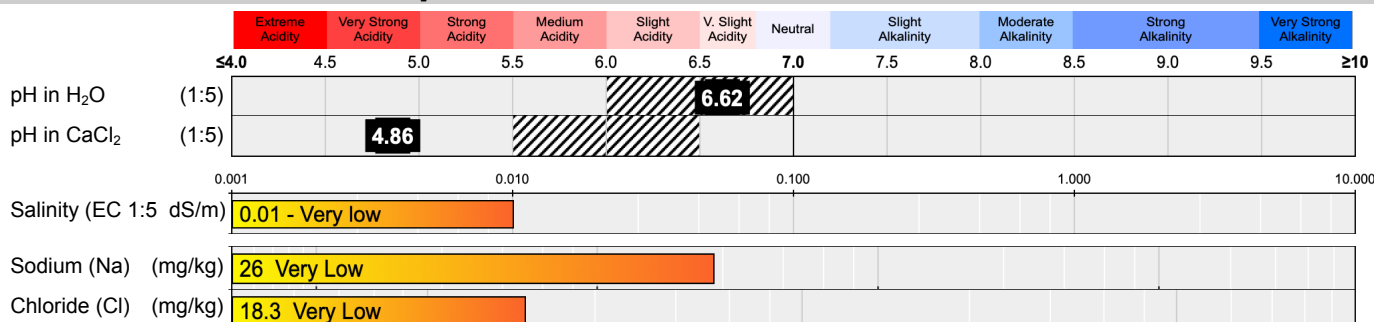
Batch N°: 67163	Sample N°: 9	Date Report Generated: 11/03/2024	Report Status: Final
Client Name: Benedict Industries Pty Ltd	Project Name: Menangle - FSC_Plus	SES L Quote N°:	
Client Contact: Results	Sample Name: Stage 8 Restoration Area PLOT 2	Description: Soil	
Client Order N°:	Test Type: FSC_Plus		
Address: PO Box 431 FRENCHS FOREST NSW 1640			

RECOMMENDATIONS

Analysed by SES L Australia Pty Ltd, NATA #15633

Results Only Requested

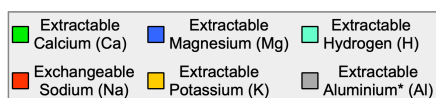
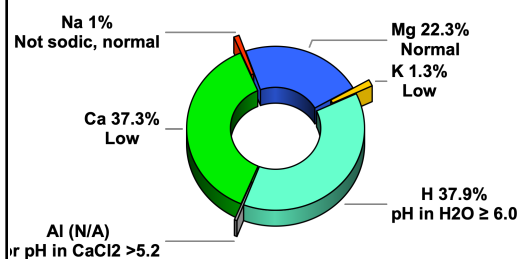
pH and ELECTRICAL CONDUCTIVITY



CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in CaCl₂ ≤ 5.5
Al only determined if pH in CaCl₂ is ≤ 5.2



EFFECTIVE CATION EXCHANGE CAPACITY (eCEC) (cmol(+)/kg)



CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	1.7	3 – 6
Comment: Calcium low		
Mg:K	20	2.6 – 5.0
Comment: Potential Potassium		
K/(Ca+Mg)	0.02	< 0.07
Comment: Acceptable		
K:Na	1.3	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.11	0.14	3.99	2.39	4.06	0

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.
The units of eCEC cmol(+)/kg are the SI unit and are equivalent to meq/100g.

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy



Soil Chemistry Profile Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163	Sample N°: 9	Date Report Generated: 11/03/2024	Report Status: Final
Client Name: Benedict Industries Pty Ltd	Project Name: Menangle - FSC_Plus	SES L Quote N°:	
Client Contact: Results	Sample Name: Stage 8 Restoration Area PLOT 2	Description: Soil	
Client Order N°:	Test Type: FSC_Plus		
Address: PO Box 431 FRENCHS FOREST NSW 1640			

PLANT AVAILABLE NUTRIENTS							
EFFECTIVE AMELIORATION DEPTH (mm): ☉ 100 ○ 150 ○ 200				DESIRED FERTILITY CLASS: ○ Low ☉ Moderate ○ High			
Major Nutrients	Unit	Result	Very Low Low Marginal Adequate High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)	
Nitrate-N (NO ₃)	mg N/kg	1.2		0.2	4	3.8	
Phosphorus (P)	mg P/kg	5.2		0.7	8.4	7.7	
Potassium (K)	mg/kg	53		7	34.8	27.8	
Sulfur (S)	mg S/kg	12		1.6	9	7.4	
Calcium (Ca)	mg/kg	800		106.4	248	141.6	
Magnesium (Mg)	mg/kg	290		38.6	25.8	Drawdown	
Iron (Fe)	mg/kg	220		29.3	73.4	44.1	
Manganese (Mn)	mg/kg	18		2.4	5.9	3.5	
Zinc (Zn)	mg/kg	<0.65		0.1	0.7	0.6	
Copper (Cu)	mg/kg	0.67		0.1	0.8	0.7	
Boron (B)	mg/kg	<0.1		0	0.4	0.4	

Explanation of graph ranges:

Very Low

Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90 %.

Low

Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90 %.

Marginal

Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

Adequate

Supply of this nutrient is adequate for the plant, and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30 %.

High

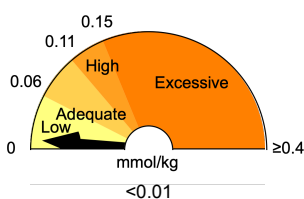
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the Adequate band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.

Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed Adequate.

* g/sqm measurements are based on soil bulk density of 1.33 tonne/m³ and effective amelioration depth.

Phosphorus Saturation Index



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH): **7.4**
Sum of Base Cations (cmol(+)/kg): **6.6**
Eff. Cation Exch. Capacity (eCEC): **10.7**
Base Saturation (%): **61.68**
Exchangeable Acidity (cmol(+)/kg): **-**
Exchangeable Acidity (%): **-**

Lime Application Rate (g/sqm)

– to achieve pH 6.0: **0**
– to neutralise Al: **0**

Calculated Gypsum Application Rate (CGAR)

(g/sqm) to achieve 67.5 % exch. Ca: **370**

The CGAR is corrected for the selected effective amelioration depth (100 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture: Sandy Loam	Munsell Colour: -	Organic Carbon (OC %): High - 2.4
Estimated clay content: 10 - 20%	Structure Size: Medium (11 - 25mm)	Organic Matter (OM %): 4.1
Tactually gravelly: Not gravelly	Structural Organisation: Pedal - Weak	Est. Field Capacity (% water): 26
Tactually organic: Not Organic	Structural Unit: Crumb	Est. Permanent Wilting Point (% water): 9
Calculated EC _{SE} (dS/m): 0.1	Potential infiltration rate: Rapid	Est. Plant Available Water (% water): 17
– Non-saline. Salinity effects on plants are mostly negligible.	Est. Permeability Class (mm/hr): >120	Est. Plant Available Water (mm/m): 170
	Additional comments:	

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy



Soil Chemistry Profile Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
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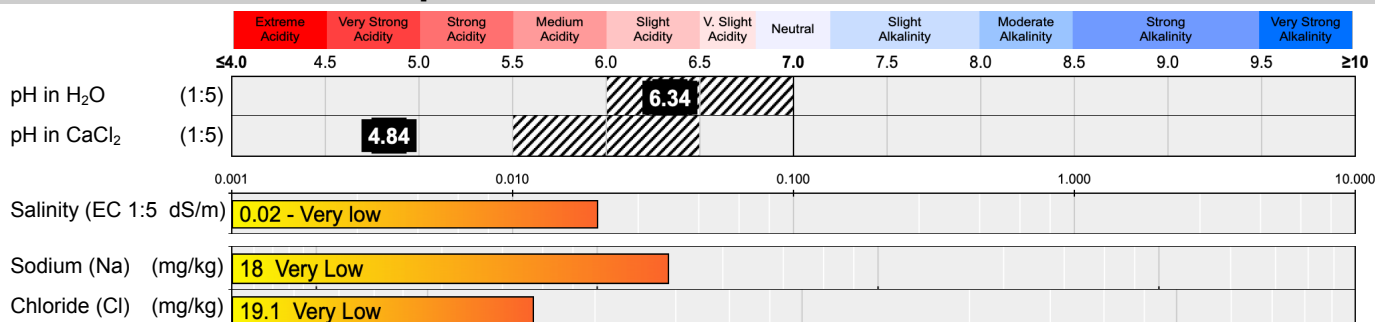
Batch N°: 67163	Sample N°: 10	Date Report Generated: 11/03/2024	Report Status: Final
Client Name: Benedict Industries Pty Ltd	Project Name: Menangle - FSC_Plus	SES L Quote N°:	
Client Contact: Results	Sample Name: Stage 8 Restoration Area PLOT 3	Description: Soil	
Client Order N°:	Test Type: FSC_Plus		
Address: PO Box 431 FRENCHS FOREST NSW 1640			

RECOMMENDATIONS

Analysed by SES L Australia Pty Ltd, NATA #15633

Results Only Requested

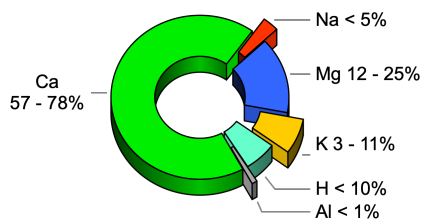
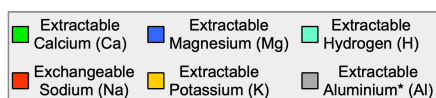
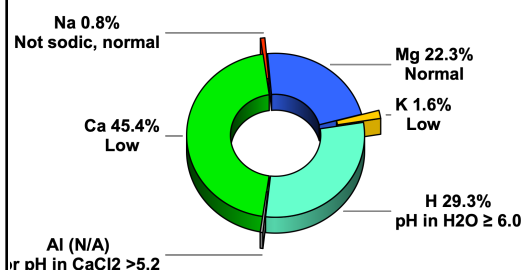
pH and ELECTRICAL CONDUCTIVITY



CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in CaCl₂ ≤ 5.5
Al only determined if pH in CaCl₂ is ≤ 5.2



ACTUAL

IDEAL

EFFECTIVE CATION EXCHANGE CAPACITY (eCEC) (cmol(+)/kg)



CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	2	3 – 6
Comment: Calcium low		
Mg:K	10	2.6 – 5.0
Comment: Potassium low		
K/(Ca+Mg)	0.02	< 0.07
Comment: Acceptable		
K:Na	2	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.08	0.16	4.45	2.19	2.87	0

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.
The units of eCEC cmol(+)/kg are the SI unit and are equivalent to meq/100g.

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy



Soil Chemistry Profile Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 67163	Sample N°: 10	Date Report Generated: 11/03/2024	Report Status: Final
Client Name: Benedict Industries Pty Ltd	Project Name: Menangle - FSC_Plus	SES L Quote N°:	
Client Contact: Results	Sample Name: Stage 8 Restoration Area PLOT 3	Description: Soil	
Client Order N°:	Test Type: FSC_Plus		
Address: PO Box 431 FRENCHS FOREST NSW 1640			

PLANT AVAILABLE NUTRIENTS							
EFFECTIVE AMELIORATION DEPTH (mm): ☉ 100 ○ 150 ○ 200				DESIRED FERTILITY CLASS: ○ Low ☉ Moderate ○ High			
Major Nutrients	Unit	Result	Very Low Low Marginal Adequate High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)	
Nitrate-N (NO ₃)	mg N/kg	2.5		0.3	4	3.7	
Phosphorus (P)	mg P/kg	6.3		0.8	8.4	7.6	
Potassium (K)	mg/kg	64		8.5	29.3	20.8	
Sulfur (S)	mg S/kg	12		1.6	9	7.4	
Calcium (Ca)	mg/kg	890		118.4	208.3	89.9	
Magnesium (Mg)	mg/kg	270		35.9	21.7	Drawdown	
Iron (Fe)	mg/kg	180		23.9	73.4	49.5	
Manganese (Mn)	mg/kg	15		2	5.9	3.9	
Zinc (Zn)	mg/kg	2.2		0.3	0.7	0.4	
Copper (Cu)	mg/kg	0.74		0.1	0.8	0.7	
Boron (B)	mg/kg	0.26		0	0.4	0.4	

Explanation of graph ranges:

Very Low

Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90 %.

Low

Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90 %.

Marginal

Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

Adequate

Supply of this nutrient is adequate for the plant, and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30 %.

High

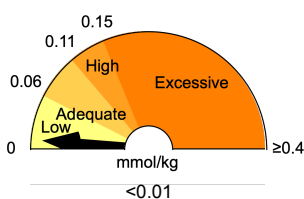
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the Adequate band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.

Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed Adequate.

* g/sqm measurements are based on soil bulk density of 1.33 tonne/m³ and effective amelioration depth.

Phosphorus Saturation Index



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH): **7.5**
Sum of Base Cations (cmol(+)/kg): **6.9**
Eff. Cation Exch. Capacity (eCEC): **9.8**
Base Saturation (%): **70.41**
Exchangeable Acidity (cmol(+)/kg): **-**
Exchangeable Acidity (%): **-**

Lime Application Rate (g/sqm)

– to achieve pH 6.0: **0**
– to neutralise Al: **0**

Calculated Gypsum Application Rate (CGAR)

(g/sqm) to achieve 67.5 % exch. Ca: **248**

The CGAR is corrected for the selected effective amelioration depth (100 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture: Sandy Loam	Munsell Colour: -	Organic Carbon (OC %): Moderate - 1.9
Estimated clay content: 10 - 20%	Structure Size: Medium (11 - 25mm)	Organic Matter (OM %): 3.2
Tactually gravelly: Not gravelly	Structural Organisation: Pedal - Weak	Est. Field Capacity (% water): 26
Tactually organic: Not Organic	Structural Unit: Crumb	Est. Permanent Wilting Point (% water): 9
Calculated EC _{SE} (dS/m): 0.3	Potential infiltration rate: Rapid	Est. Plant Available Water (% water): 17
– Non-saline. Salinity effects on plants are mostly negligible.	Est. Permeability Class (mm/hr): >120	Est. Plant Available Water (mm/m): 170
	Additional comments:	

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy



Soil Chemistry Profile Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
Em: info@sesl.com.au
Web: www.sesl.com.au

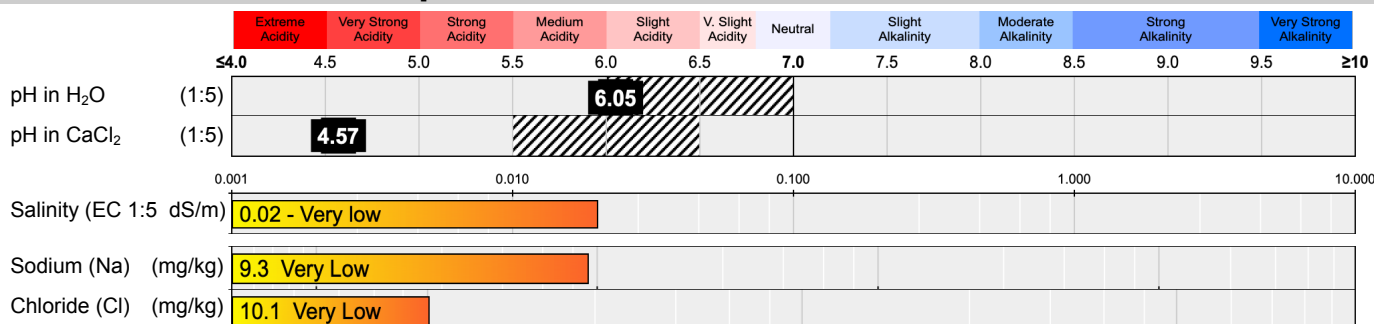
Batch N°: 67163	Sample N°: 11	Date Report Generated: 11/03/2024	Report Status: Final
Client Name: Benedict Industries Pty Ltd	Project Name: Menangle - FSC_Plus	SES L Quote N°:	
Client Contact: Results	Sample Name: Substage 8A Restoration Area PLOT 1	Description: Soil	
Client Order N°:	Test Type: FSC_Plus		
Address: PO Box 431 FRENCHS FOREST NSW 1640			

RECOMMENDATIONS

Analysed by SES L Australia Pty Ltd, NATA #15633

Results Only Requested

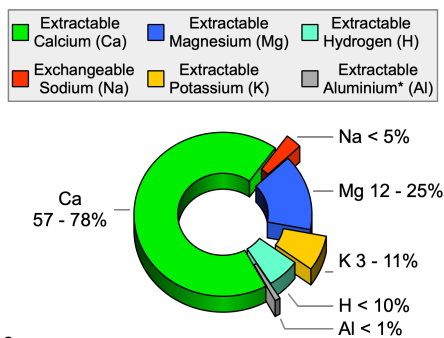
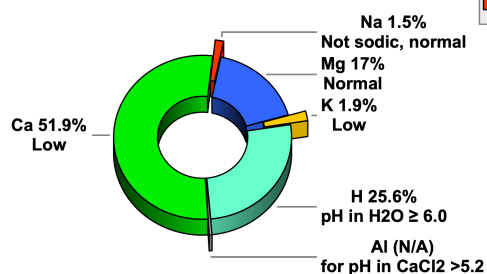
pH and ELECTRICAL CONDUCTIVITY



CATION BALANCE

EXCHANGEABLE CATION PERCENTAGE

Note: Hydrogen only determined when pH in CaCl₂ ≤ 5.5
Al only determined if pH in CaCl₂ is ≤ 5.2



EFFECTIVE CATION EXCHANGE CAPACITY (eCEC) (cmol(+)/kg)



CATION RATIOS

Ratio	Result	Target Range
Ca:Mg	3	3 – 6
Comment: Balanced		
Mg:K	9	2.6 – 5.0
Comment: Potassium low		
K/(Ca+Mg)	0.03	< 0.07
Comment: Acceptable		
K:Na	1.3	N/A

EXCHANGEABLE CATIONS (cmol(+)/kg)

Na:	K:	Ca:	Mg:	H:	Al:
0.04	0.05	1.4	0.46	0.69	0

eCEC does not include correction for soluble salts as standard. Where exchangeable calcium exceeds 80 % of eCEC and/or salinity exceeds 0.75 dS/m, alternative methods are recommended to determine true eCEC.
The units of eCEC cmol(+)/kg are the SI unit and are equivalent to meq/100g.

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy



Soil Chemistry Profile Mehlich 3 - Multi-nutrient Extractant

Sample Drop Off: 16 Chilvers Road
Thornleigh NSW 2120

Tel: 1300 30 40 80
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Batch N°: 67163	Sample N°: 11	Date Report Generated: 11/03/2024	Report Status: Final
Client Name: Benedict Industries Pty Ltd	Project Name: Menangle - FSC_Plus	SES L Quote N°:	
Client Contact: Results	Sample Name: Substage 8A Restoration Area PLOT 1	Description: Soil	
Client Order N°:	Test Type: FSC_Plus		
Address: PO Box 431 FRENCHS FOREST NSW 1640			

PLANT AVAILABLE NUTRIENTS							
EFFECTIVE AMELIORATION DEPTH (mm): ☉ 100 ○ 150 ○ 200				DESIRED FERTILITY CLASS: ○ Low ☉ Moderate ○ High			
Major Nutrients	Unit	Result	Very Low Low Marginal Adequate High	Result (g/sqm)	Desirable (g/sqm)	Adjustment (g/sqm)	
Nitrate-N (NO ₃)	mg N/kg	3.7		0.5	4	3.5	
Phosphorus (P)	mg P/kg	8.1		1.1	8.4	7.3	
Potassium (K)	mg/kg	18		2.4	23.7	21.3	
Sulfur (S)	mg S/kg	14		1.9	9	7.1	
Calcium (Ca)	mg/kg	280		37.2	168.5	131.3	
Magnesium (Mg)	mg/kg	56		7.4	17.8	10.4	
Iron (Fe)	mg/kg	190		25.3	73.4	48.1	
Manganese (Mn)	mg/kg	15		2	5.9	3.9	
Zinc (Zn)	mg/kg	1.3		0.2	0.7	0.5	
Copper (Cu)	mg/kg	<0.64		0.1	0.8	0.7	
Boron (B)	mg/kg	<0.1		0	0.4	0.4	

Explanation of graph ranges:

Very Low

Growth is likely to be severely depressed and deficiency symptoms present. Large applications for soil building purposes are usually recommended. Potential response to nutrient addition is >90 %.

Low

Potential "hidden hunger", or sub-clinical deficiency. Potential response to nutrient addition is 60 to 90 %.

Marginal

Supply of this nutrient is barely adequate for the plant, and build-up is still recommended. Potential response to nutrient addition is 30 to 60 %.

Adequate

Supply of this nutrient is adequate for the plant, and only maintenance application rates are recommended. Potential response to nutrient addition is 5 to 30 %.

High

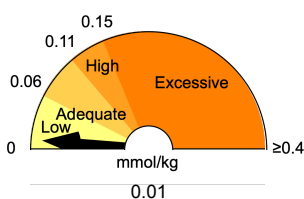
The level is excessive and may be detrimental to plant growth (i.e. phytotoxic) and may contribute to pollution of ground and surface waters. Drawdown is recommended. Potential response to nutrient addition is <2 %.

NOTES: Adjustment recommendation calculates the elemental application to shift the soil test level to within the Adequate band, which maximises growth/yield, and economic efficiency, and minimises impact on the environment.

Drawdown: The objective nutrient management is to utilise residual soil nutrients. There is no agronomic reason to apply fertiliser when soil test levels exceed Adequate.

* g/sqm measurements are based on soil bulk density of 1.33 tonne/m³ and effective amelioration depth.

Phosphorus Saturation Index



Low. Plant response to applied P is likely.

Exchangeable Acidity

Adams-Evans Buffer pH (BpH): **7.9**
Sum of Base Cations (cmol(+)/kg): **2**
Eff. Cation Exch. Capacity (eCEC): **2.7**
Base Saturation (%): **74.07**
Exchangeable Acidity (cmol(+)/kg): **-**
Exchangeable Acidity (%): **-**

Lime Application Rate (g/sqm)

– to achieve pH 6.0: **0**
– to neutralise Al: **0**

Calculated Gypsum Application Rate (CGAR)

(g/sqm) to achieve 67.5 % exch. Ca: **48**

The CGAR is corrected for the selected effective amelioration depth (100 mm) and any Lime addition to achieve pH 6.0.

PHYSICAL DESCRIPTION

Texture: Sand	Munsell Colour: -	Organic Carbon (OC %): Low - 0.7
Estimated clay content: < 5%	Structure Size: Fine (1 - 10mm)	Organic Matter (OM %): 1.1
Tactually gravelly: Not gravelly	Structural Organisation: Pedal - Weak	Est. Field Capacity (% water): 8 - 14
Tactually organic: Not Organic	Structural Unit: Crumb	Est. Permanent Wilting Point (% water): 4
Calculated EC _{SE} (dS/m): 0.5	Potential infiltration rate: Very Rapid	Est. Plant Available Water (% water): 4 - 10
– Non-saline. Salinity effects on plants are mostly negligible.	Est. Permeability Class (mm/hr): >120	Est. Plant Available Water (mm/m): 40 - 100
	Additional comments:	

Consultant:
Annalise Grieve

Authorised Signatory:
Owen Guy

**Site Rehabilitation and Restoration
Annual Progress Report
Menangle Sand and Soil Pty Ltd**



**Benedict Sands Menangle
(LEC 2018/342158)
01 January 2024 - 31 December 2024
March 2025**

Version	Date	Prepared by	Approved by	Comments
v1	11/2/25	E.Mckenzie	E.Dupere	updated
V2	12/3/25	E.McKenzie	E.Dupere	updated
V3	20/3/25	E.McKenzie	E.Dupere	updated
V4	28/3/25	E.Mckenzie	E.Dupere	updated
V5	30/3/25	E.McKenzie	E.Dupere	Final

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Attachments

A	Drainage, erosion and sediment control inspections record
B	Initial soil performance indicators
C	Soil Chemistry Laboratory reports on initial soil conditions
D	Restoration Area 1 management summary
E	Ecological Monitoring Report 2024
	Floristic plot data
	Floristic monitoring report
	Photo-point monitoring
	Weed mapping records
F	Planting Guidelines and Plant Species List
G	Nest box monitoring records
H	Menangle Sand and Soil – Stage 8 Extraction Area changes to the Rehabilitation Methodology

1 Introduction

1.1 Background

Menangle Sand and Soil Pty Ltd (MSS) operates the Menangle Sand and Soil Quarry ('the quarry') at 15 Menangle Road, Menangle.

1.2 Consent

On 15 November 1989 the Minister for Planning, approved Development Consent 85/2865, allowing the quarry to extract sand and soil along the Nepean River and to process and blend material.

On 10 September 2020, the NSW Land and Environment Court (LEC) approved the Menangle Quarry Extension – Modification 1 (MOD1) to Development Consent 85/2865. Consent conditions are provided in the Notice of Orders for LEC 2018/342158).

On 5 November 2021, the Minister for Planning approved Menangle Quarry Extension – Modification 2 (MOD2) to Development Consent 85/2865.

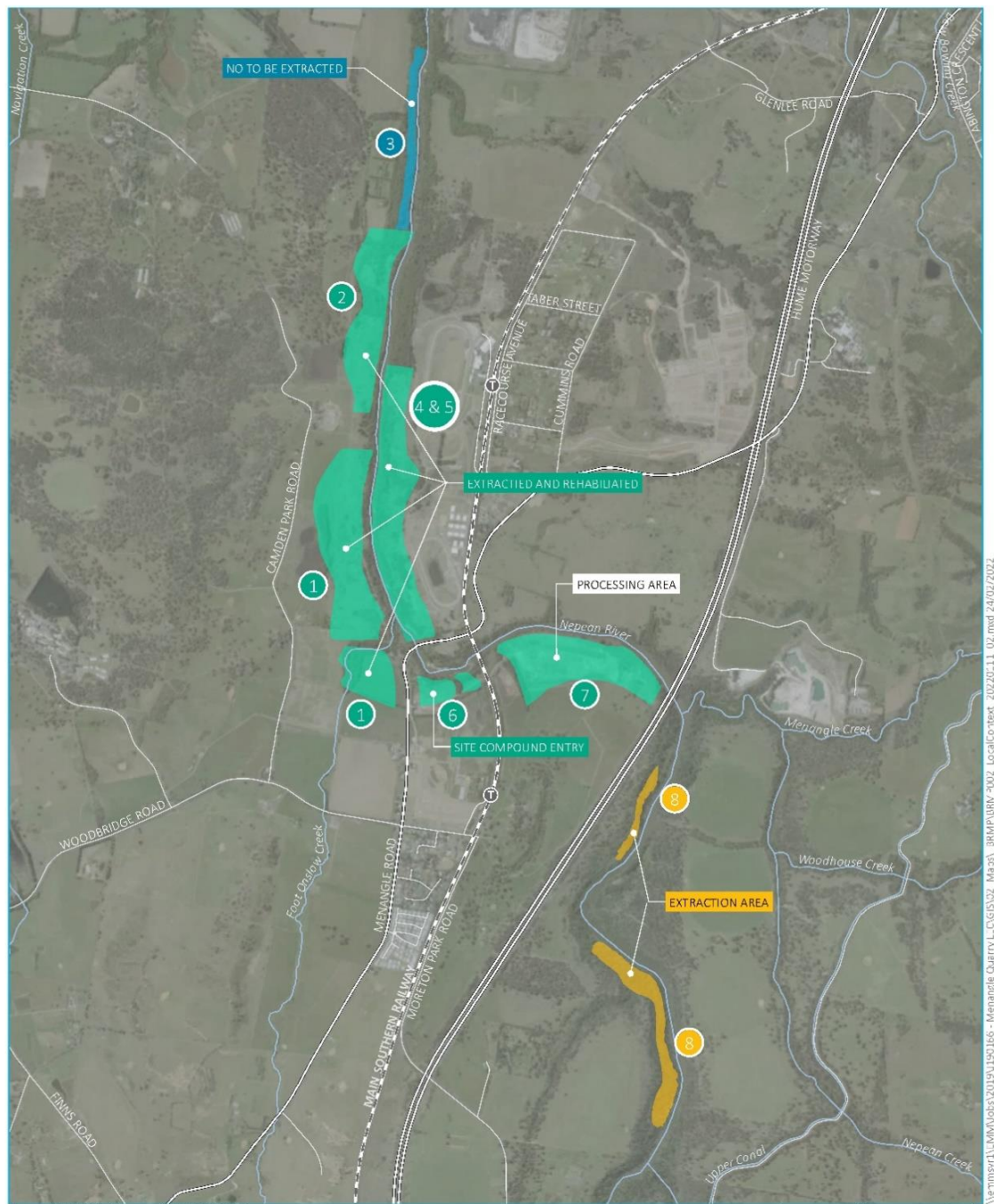
The Consent allows the extraction of sand and soil in the Stage 8 area and processing and other operations in the Stage 6 and 7 areas (FIGURE 1).

Quarrying activities commenced in Stage 8 on 4 September 2023 and the Department was formally notified as such.

This is the second Site Rehabilitation and Restoration Annual Progress Report prepared by Menangle Sand and Soil Pty Ltd with input from consultants EMM.

1.3 Biodiversity and rehabilitation management

The *Menangle Sand and Soil Quarry Biodiversity and Rehabilitation Plan* (BRMP) was prepared to meet Consent Condition B73. The BRMP (current version 5, 11 September 2024) describes the ongoing management of vegetation in the Stage 6 and Stage 7 areas as well as in the new Stage 8, Substage 8A–8C extraction areas and Restoration Area 1 (FIGURE 2). Restoration Area 1 forms part of the biodiversity offsets to compensate for impacts to vegetation because of the Menangle Quarry Extension. Menangle Sand and Soil has rehabilitated substantial additional areas not required by the Consent to demonstrate its commitment to the final state of its lands, which are owned by a related entity.



Source: EMM (2022); Metromap (2022); DFSI (2017)

KEY

- ① Train station
- Rail line
- Main road
- Local road
- Named watercourse
- Extractive operations (approved)
- Extractive operations (approved but not extracted)
- Stage 8 - extraction/rehabilitation area

Menangle Quarry stages 1 to 8

Menangle Sand and Soil Quarry
Figure 1.2



FIGURE 1. Menangle Quarry Stages 1 to 8

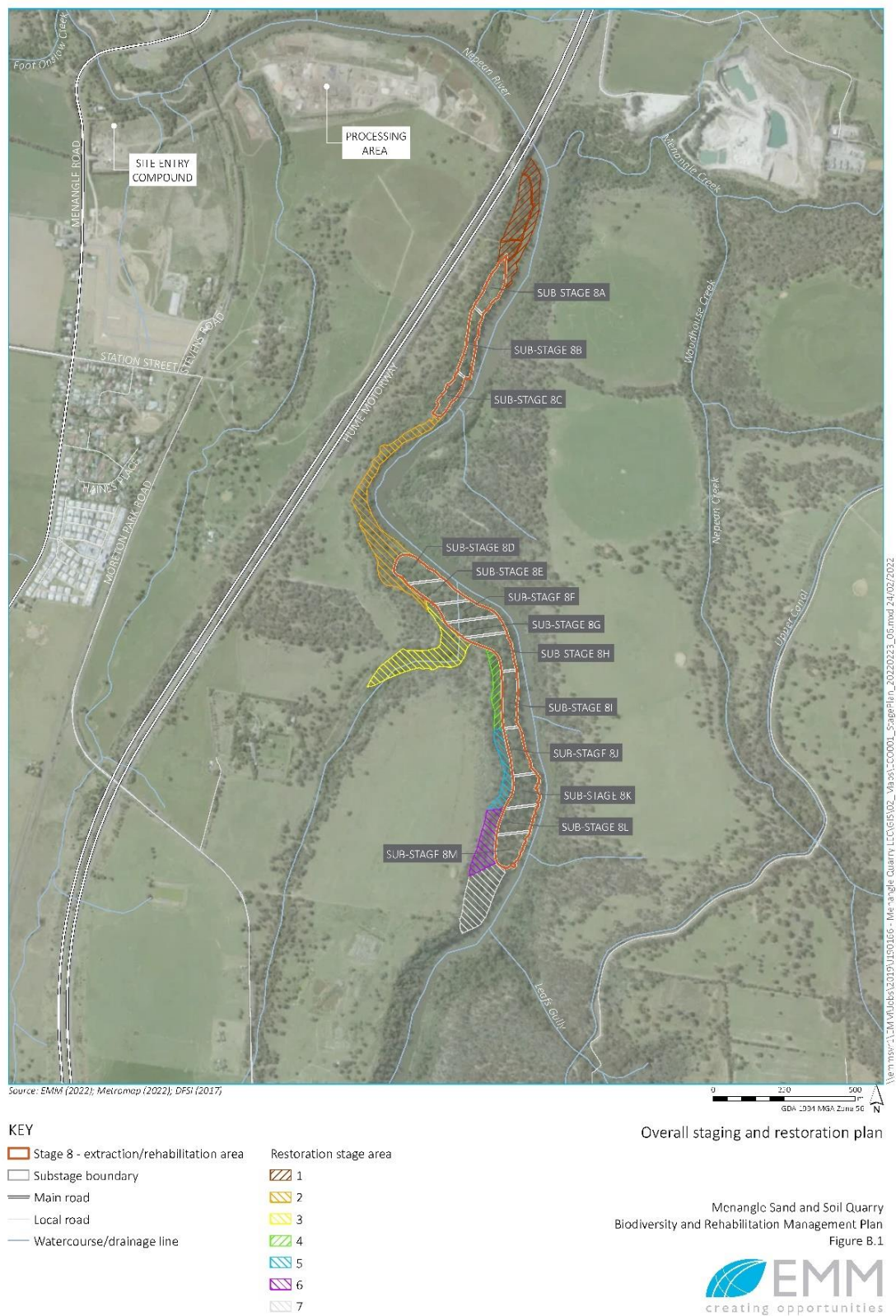


FIGURE 2. Overall Staging and Restoration Plan

1.4 Biodiversity and Rehabilitation Management Plan reporting

The annual reporting is described in BRMP Section 8.8.

This Rehabilitation and Restoration Site Annual Progress Report addresses the reporting requirements listed in BRMP Section 8.8. It provides:

1. landform establishment and stability assessment (see BRMP Section 8.3.1);
2. growth medium development assessment (see BRMP Section 8.3.2);
3. floristic monitoring report (see BRMP Section 8.4.1);
4. weed monitoring report (see BRMP Section 8.4.2); and
5. nest-box and woody debris report (see BRMP Sections 8.4.3 and 8.4.4).

The reporting period is January 2024 to December 2024. Some additional, more recent data is included from the period Jan25-Mar25

The BRMP states that MSS will complete and submit an Annual Review report to DPE for by the end of March each year (see Section 7.2 of the *Menangle Sand and Soil Quarry Environmental Management Strategy*). The rehabilitation and restoration activities, monitoring results, and progress towards achieving the completion criteria are to be reported in the Annual Review.

2 Landform establishment, stability and growth medium

2.1 Introduction

Landform establishment, stability and growth medium completion/performance indicators are provided in BRMP Table 8.1.

2.2 Management actions, performance/completion criteria, observations and effectiveness

Management actions in the reporting period, progress towards meeting the performance/completion criteria, the effectiveness of management actions, and progressive improvements are provided in the table below.

There were two significant Nepean River flood events that occurred during the 2024 Annual Review period that have had a significant impact on the success and progress rehabilitation and restoration efforts. Significant flooding occurred in the catchment area on the 6th April 2024 and again on the 6th June 2024 that eliminated and damaged rehabilitation planting and seeding from 2023 and early 2024 as well as left a silt residue over significant areas that also brought with it weeds and other debris from further up the catchment. The nett impact of this has been to persist but also review the methodology and establish a more effective way to restore the vegetation and being able to tolerate and survive increasing flood events in the future. Reference to the impacts will be included in the summary below as well as photos of the typical damage incurred. An independent assessment of the specific rehabilitation planting methodology was conducted in October 2024 by Urban Agronomy & Soil Science. The report titled Menangle Sand and Soil – Stage 8 Extraction Area Changes to the Rehabilitation Methodology October 2024 is now included as Attachment H to this Progress report.

Landform establishment, stability and growth medium summary							
Management actions	Performance/completion criteria	Progress against performance/completion criteria			Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)	Visual observations, monitoring results and trends	Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)
		Required completion year	Anticipated/actual completion year	Action completed? (Yes/No)			
STAGE 6 & 7 - Establish stable final landform areas							
STAGE 6 Establish stable final landform area		Completed	Completed	See below	-	The area is formed, stable, and revegetated	completed
	The final landform is suitable for the final land uses and	-	-	Yes	None	As above	completed

Landform establishment, stability and growth medium summary							
Management actions	Performance/completion criteria	Progress against performance/completion criteria			Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)	Visual observations, monitoring results and trends	Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)
		Required completion year	Anticipated/actual completion year	Action completed? (Yes/No)			
	generally compatible with surrounding topography.						
	No reduction in flood storage capacity, compared with pre-development conditions.	-	-	Yes	None	The final landform is lower than the former landform, so we created flood storage volume	completed
	Final landform incorporates geomorphological features to allow for the free draining discharge of clean water.	-	-	Yes	None	It is suitably formed	completed
	Minimal sediment-laden run-off into the Nepean River.	-	-	Yes	None	There is no sediment laden water being produced	
STAGE 7 Establish stable final landform in non-operational area		2022	2026	See below	-	The landform is stable but being reshaped to form a more useful final landform	
	The final landform is suitable for the final land uses and generally compatible with surrounding topography.			No	It is being modified/reshaped	As above	It will be reshaped by mid-2025 as flood affected
	No reduction in flood storage capacity, compared with pre-development conditions.			No	As above	As above	The landform provides more flood storage than the pre-extraction landform
	Final landform incorporates geomorphological features to			Yes	As above	As above	

Landform establishment, stability and growth medium summary							
Management actions	Performance/completion criteria	Progress against performance/completion criteria			Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)	Visual observations, monitoring results and trends	Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)
		Required completion year	Anticipated/actual completion year	Action completed? (Yes/No)			
	allow for the free draining discharge of clean water.						
	Minimal sediment-laden run-off into the Nepean River.			Yes	As above	The banks are grassed with Kikuyu and are stable	It will be supplemented with plantings of some riverine tree species
STAGE 7 Establish stable final landform in the operational area (post-closure)		2036	2036	No	-	The Processing Area continues to be used. Final landform will be established following the completion of quarry operations.	-
	The final landform is suitable for the final land uses and generally compatible with surrounding topography.			No	None	- Monitoring Plots succeeding	- Flood affected
	No reduction in flood storage capacity, compared with pre-development conditions.			No	None	- Still is completely covered in flood periods	- No
	Final landform incorporates geomorphological features to allow for the free draining discharge of clean water.			No	None	-	-
	Minimal sediment-laden run-off into the Nepean River.			Yes	None	-	-

Landform establishment, stability and growth medium summary							
Management actions	Performance/completion criteria	Progress against performance/completion criteria			Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)	Visual observations, monitoring results and trends	Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)
		Required completion year	Anticipated/actual completion year	Action completed? (Yes/No)			
SUBSTAGE 8A - Establish stable final landform areas							
SUBSTAGE 8A The final landform is consistent with the Consent		2024	2023	Yes	The extraction of Substage 8A is completed and the final landform has been created. Weedy topsoil and weedy vegetated materials from the advancing quarry were placed in the floor of the completed extraction area to build up the final landform. The completed extraction area has been backfilled to approximately 64 m AHD with scalps, coarse rejects and soil.	Slope angles are consistent with the Consent and the SWMP: <ul style="list-style-type: none">riverside batter: 1:5;extraction area: minimum 1:50 slope towards swale at base of riverside batter; andlandward batter: maximum of 1:1, except where the batter is formed by the natural sandstone rock escarpment, which may be steep/vertical in places.	
	The final landform is suitable for the final land uses and generally compatible with surrounding topography.			Yes	As above.	As above.	The timber and brush stations were placed, and the area has been Hydroseeded with the recommended species mix. Flood affected – reviewing methodology
	No reduction in flood storage capacity, compared with pre-development conditions.			No	As above.	As above.	The extraction has resulted in a net loss of materials in this area
	Final landform incorporates geomorphological features to				Yes	As above.	As above.

Landform establishment, stability and growth medium summary							
Management actions	Performance/completion criteria	Progress against performance/completion criteria			Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)	Visual observations, monitoring results and trends	Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)
		Required completion year	Anticipated/actual completion year	Action completed? (Yes/No)			
	allow for the free draining discharge of clean water.						table which is only a few metres below
	Minimal sediment-laden runoff into the Nepean River.			Yes	The area has been hydroseeded and has a cover crop	The final landform profile prevents runoff from the extraction area as its lower than the 10m buffer	Effective
SUBSTAGE 8A The landform area is stable	Areas of active erosion are minimised.	2024	2023	Yes	The area was rehabilitated as intended as well as two large adjoining Additional Restoration Areas (outside of the Extraction Area and the Restoration Area 1) was weeded and mulched (and selected eucalypts were planted) to reduce the migration of weeds into the rehabilitated areas.	Spot spraying of weeds has been required in the Additional Restoration Areas as well as in the Restoration Area 1 and Substage 8A Extraction areas. This has not affected land stability but is monitored as the ground is exposed after weed removal. The landform has survived the two flood events	The Additional Restoration Areas (see Figure 5) allows a bigger buffer between other areas. Brush and debris and small plantings did not survive very well after the flooding events and silt deposits. Adaptive planting methods have been now used
	No areas of active erosion as determined by: <ul style="list-style-type: none"> no drills/gullies no sheet erosion present no tunnel erosion present. 			No	See Attachment A: Drainage, erosion and sediment control inspections record.	See Attachment A: Drainage, erosion and sediment control inspections record.	There are no significant areas of active erosion.

Landform establishment, stability and growth medium summary							
Management actions	Performance/completion criteria	Progress against performance/completion criteria			Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)	Visual observations, monitoring results and trends	Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)
		Required completion year	Anticipated/actual completion year	Action completed? (Yes/No)			
SUBSTAGE 8B - Establish stable final landform areas							
SUBSTAGE 8B the final landform is consistent with the Consent	The final landform is suitable for the final land uses and generally compatible with surrounding topography. No reduction in flood storage capacity, compared with pre-development conditions. The final landform incorporates geomorphological features to allow for the free draining discharge of clean water. Minimal sediment-laden run-off into the Nepean River.	2025	2024	See below	Extraction of the Substage 8B area commenced in Feb 2024	- The final landform profile prevents runoff from the extraction area as its lower than the 10m buffer	- The timber and brush stations were placed and the area has been Hydroseeded with the recommended species mix. Flood affected as per Substage 8A so adaptive planting methodology has been utilised
SUBSTAGE 8B The landform area is stable	Areas of active erosion are minimised.	2025	Late 2024	See below	Extraction of Substage 8B area commenced in Feb 2024.	- See Attachment A: Drainage, erosion and sediment control inspections record.	- No significant erosion areas but loss of plantings
SUBSTAGE 8C - Establish stable final landforms in the area							
SUBSTAGE 8C The final landform is consistent with the Consent	The final landform is suitable for the final land uses and generally compatible with surrounding topography. No reduction in flood storage capacity, compared with pre-development conditions.	2026	2024	See below	Extraction of the Substage 8C commenced in April 2024	- The final landform profile prevents runoff from the extraction area as its lower than the 10m buffer	- The timber and brush stations were placed and the area has been Hydroseeded with the recommended species mix. Flood affected as above – reviewing methodology

Landform establishment, stability and growth medium summary							
Management actions	Performance/completion criteria	Progress against performance/completion criteria			Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)	Visual observations, monitoring results and trends	Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)
		Required completion year	Anticipated/actual completion year	Action completed? (Yes/No)			
	The final landform incorporates geomorphological features to allow for the free draining discharge of clean water. Minimal sediment-laden run-off into the Nepean River.						
SUBSTAGE 8C The Landform is stable	Areas of active erosion are minimised.	2026	2024	See below	Extraction of the Substage 8C commenced in April 2024	- See Attachment A: Drainage, erosion and sediment control inspections record.	-
SUBSTAGE 8D – Establish stable final landforms in the area							
SUBSTAGE 8D The Landform is stable	The final landform is suitable for the final land uses and generally compatible with surrounding topography. No reduction in flood storage capacity, compared with pre-development conditions. The final landform incorporates geomorphological features to allow for the free draining discharge of clean water. Minimal sediment-laden run-off into the Nepean River.	2027	2025	See below	Extraction of Substage 8D commenced in October 2024	Landform is stable and not been affected by flooding	
RESTORATION AREA 1 & 2 - Establish stable final landform areas							

Landform establishment, stability and growth medium summary							
Management actions	Performance/completion criteria	Progress against performance/completion criteria			Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)	Visual observations, monitoring results and trends	Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)
		Required completion year	Anticipated/actual completion year	Action completed? (Yes/No)			
RESTORATION AREA 1 The landform is stable	Areas of active erosion are minimised.	2024	2024	Yes	Reshaping, grading, and placing of timbers, and hydroseeding to HN526 has occurred. Weed spraying is occurring as is irrigation.	The cover crop and some weeds have reestablished	Generally good but we are awaiting the emergence of the Hydroseeded HN526 bushes and trees
	No areas of active erosion as determined by: <ul style="list-style-type: none"> no drills/gullies no sheet erosion present no tunnel erosion present. 	2024	2024	No	There are no areas of active erosion. See Attachment A: Drainage, erosion and sediment control inspections record.	See Attachment A: Drainage, erosion and sediment control inspections record.	The area is relatively flat as was originally mined in the 1920's for the Sydney Harbour Bridge construction sand
RESTORATION AREA 2 The landform is stable	No areas of active erosion	2030	2030	No	The area is generally too steep and rocky for significant rehabilitation works by machine. Proposed selective removal of weed species and selective replacement by hand due to steep site conditions and protection of existing native vegetation.	See Appendix E	Not Commenced rehabilitation as yet
	No areas of active erosion as determined by: <ul style="list-style-type: none"> no drills/gullies no sheet erosion present 			No	N/A	N/A	N/A

Landform establishment, stability and growth medium summary							
Management actions	Performance/completion criteria	Progress against performance/completion criteria			Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)	Visual observations, monitoring results and trends	Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)
		Required completion year	Anticipated/actual completion year	Action completed? (Yes/No)			
	no tunnel erosion present.						
STAGE 6 & 7, SUBSTAGES 8A-8C & RESTORATION AREAs 1 & 2 - Establish soil suitability for establishment and growth of River Flat Eucalypt Forest (HN526)							
Apply woody debris and habitat materials (eg branches and leaves from cleared native vegetation).							
	Substage 8A area	2023	2024	yes	See Attachments E&H	Flood affected twice – woody debris and habitats washed away	See Attachments E&H
	Substage 8B area	2024	2024	Yes	Extraction of Substage 8B commenced in Feb 2024	Flood affected twice – woody debris and habitats washed away	Ineffective except for large logs – implemented long stem planting approach in clumps See Attachment E&H
	Substage 8C area	2025	2025	Yes	Extraction of the Substage 8C is commenced In April 2024	Flood affected twice – woody debris and habitats washed away	Ineffective except for large logs – implemented long stem planting approach in clumps See Attachments E&H
	Substage 8D area	2030	2025	No	Still extracting	Still extracting	Still extracting
	Restoration Area 1	2023	2023	Yes	See Attachments E&H	See Attachments E&H	See Attachments E&H
	Restoration Area 2	2030	2030	No	Land not cleared – selective hand weeding and planting	See Attachments E&H	See Attachment E&H
Establish vegetation rehabilitation plots	Stage 6 area - two 20 x 20 m vegetation rehabilitation plots established (see Figure 3, below)	2023	2023	Yes	Two vegetation plots established and are in Figure 3 - see Section 2.5 below	-	Significant Flooding Events in has hampered continuity of this stage. Flood events have occurred on 22-24 March

Landform establishment, stability and growth medium summary							
Management actions	Performance/completion criteria	Progress against performance/completion criteria			Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)	Visual observations, monitoring results and trends	Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)
		Required completion year	Anticipated/actual completion year	Action completed? (Yes/No)			
							2021, 2 March 2022 and 6 April 2022.
	Stage 7 area - five 20 x 20 m vegetation restoration plots established (see Figure 4, below)	2023	2023	Yes	Five vegetation plots established and are located in Figure 4 - see Section 2.5 below	-	As above
	Substage 8A-8C area 20 x 20 m vegetation restoration plots established (see Figures 9 & 10 below)	2025	2024	Yes for 8A No for 8B and 8C	One vegetation plot established in Substage 8A and is located in Figure 9 and shown in Figure 10 - see Section 2.5 below. The Plots will be established progressively as the final landform in each area is completed.	-	These have just been established and it's too early to assess
	Restoration Area 1 – three 20 x 20 m three vegetation restoration plots established (see Figures 6 through 8)	2023	2023	Yes	Three vegetation plots established and fenced and located in Figure 5 and shown in Figures 6,7 & 8 - see Section 2.5 below	-	Weed control has been carried out post Hydroseeding with HN526
	Restoration Area 2 – Selective weeding and planting by hand due to site conditions and access (see Figure 5)	2030	2030	No	Not commenced – Proposed 4 Vegetation plots inappropriate. Record targeted species for removal and volume of replacement planting on an annual basis	See Appendix	Not Commenced

Landform establishment, stability and growth medium summary							
Management actions	Performance/completion criteria	Progress against performance/completion criteria			Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)	Visual observations, monitoring results and trends	Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)
		Required completion year	Anticipated/actual completion year	Action completed? (Yes/No)			
Soil analysis	Soil analysis at each vegetation plot once following establishment of the final landform: <ul style="list-style-type: none"> • pH • electrical conductivity • cation exchange capacity • exchangeable sodium percentage • organic matter • phosphorus and nitrate • magnesium and aluminium. 	2024	2024	yes	Soil samples were collected from each vegetation restoration plot and from 4 locations where HN526 is currently established. Restoration plots were all affected by flooding in 2024 and deposited sand and silts. Additional Soil samples will be collected in 2025 where appropriate	Laboratory reports are provided in Attachment C.	The results will be considered, and recommendations followed
Establish soil performance indicators	Upper and lower range performance indicators to be determined during first round of monitoring based on measurements in comparable soil types supporting HN526.	2024	2024	No	Soil analysis results have been carried out and are being assessed.	Upper and lower range performance indicators are provided in Attachment B.	The results will be considered, and recommendations implemented

2.3 Additional commentary

In 2023, the quarry decided that the best results would be obtained by including the following actions:

- 1) Irrigating the rehabilitation areas when necessary, during post Hydroseeding activities until the cover crop is established.
- 2) Relocating the haul roads through already cleared adjoining grazing lands/areas so as to not allow quarry vehicles and machinery to transit through rehabilitated areas.
- 3) Clearing weeds on Additional Restoration Areas 1 & 2 (see Figure 11 below) inland to the Restoration Area 1 and covering them with a thick mulch to provide a clean buffer, reducing weed migration into the substage excavation restoration areas.
- 4) Planting Trees that are considered as suitable Koala food sources so that ultimately Koalas could be reintroduced into the corridor post-extraction (see Figure 3 below).

In late 2024 and 2025

“Menangle Sand & Soil (the Company) is revising its methodology for revegetating post extraction areas in Stage 8 of its Menangle extraction operations. This change reflects the challenges and lessons learned from recent years, where revegetation techniques involving a mix of tube stock planting and hydro mulching have faced significant setbacks due primarily to issues associated with the regularity and severity of flooding in the rehabilitation zones that has consistently deposited sand and/or silt over the revegetated areas, flooded away the brush stations put in place, burying and killing a substantial number of planted seedlings and tube stock. Additionally, these flooding events have reintroduced weed species, complicating efforts to maintain weed control across the large areas dedicated to native species re-establishment.

To address these challenges, the Company is adopting a new, more flexible approach that combines the benefits of focused planting efforts within plots and practical weed management strategies across broader areas. The goal remains the successful establishment of at least 24 of the 40 indigenous species listed in the Consent document, which aligns with the Company’s commitment to ecological restoration and long-term sustainability.” (source UASS Changes to Rehabilitation Methodology Oct 2024 p1 – See Attachment H)

The new approach will include:

- Intensive Planting Plots
- Central Log Placement
- Species Selection and Plot Groupings using
 - Colonisers and Pioneers
 - Mid-Storey Species (small trees and shrubs)
 - Canopy and long-term species
- Long-stem Tubestock Planting technique
- Stage 8 Planting Plots species
- Mulching and brush cover
- Ongoing Management

Full details are included in Attachment H

Stage 6 and Stage 7 Additional Restoration areas

MSS has planted additional areas for operational and strategic purposes which has added to the ecological diversity across the site. In Stage 6, the Company has voluntarily planted an area of some 1250m² and is growing species which are harvested as Koala food, for the Symbio Wildlife Park, in Helensburg, NSW- see area shown on

Figure. 3 “Koala Food Plantation” below. The trees are periodically harvested as a pure, reliable food supply for their Koalas.

Primary Trees (favoured) for Plantation:

Swamp Mahogany *Eucalyptus robusta*
Forest Red Gum *Eucalyptus tereticornis*
River red gum *Eucalyptus camaldulensis*
Cabbage Gum *Eucalyptus amplifolia*
Grey Gum *Eucalyptus punctata*

Secondary trees:

Tallowwood *Eucalyptus microcorys*
Pink Flowering Ironbark *Eucalyptus sideroxylon*
Nicoli *Eucalyptus nicholii*
River Red Gum *Eucalyptus camaldulensis*
Grey Box Gum *Eucalyptus microcarpa*
Scoparia *E Scoparia*

In Stage 7, MSS has planted several bund wall areas with a range of casuarinas and eucalypts to provide screening and increased post-extraction habitat areas.

This additional 26,700m² of additional Restoration Area (see Figure 4 below) represents some ~46% of increased tree-planted area that is not required by the Consent.

2.4 Measures to be taken in the next 12 months.

MSS will review the BRMP and continue to adapt and monitor the efficacy of our rehabilitation initiatives and procedures and adapt depending on success or failure. We will take on board the advice from the Floristic survey and continue to improve our delivery of successful native planting as well as specific weed management.

2.5 Restoration Stage Plans and Areas

VEGETATION MONITORING PLOTS

STAGE 6



FIGURE 3. Stage 6 Restoration Area with two Vegetation Monitoring Plot locations

STAGE 7

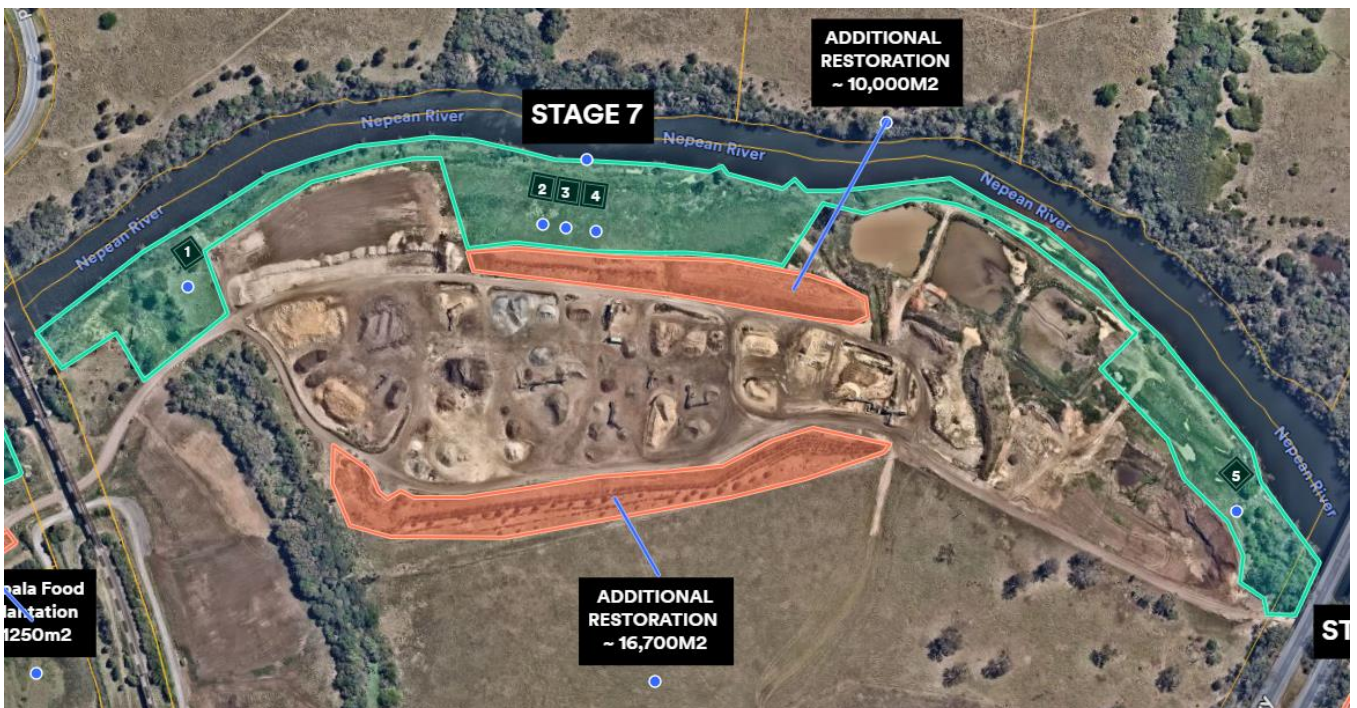
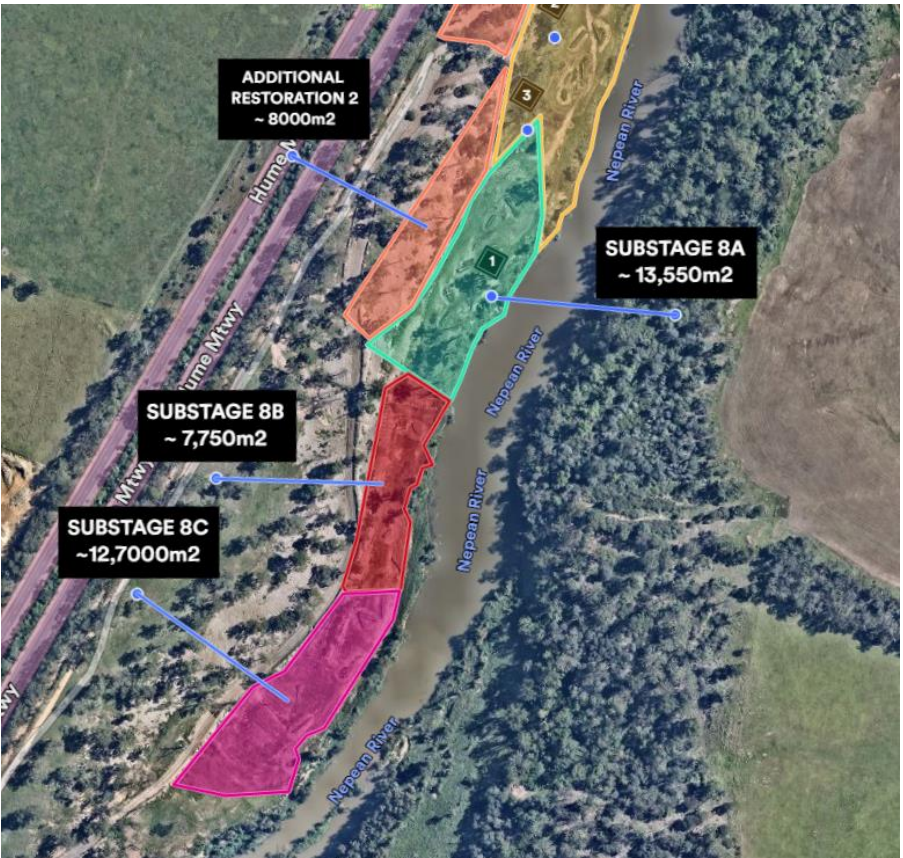
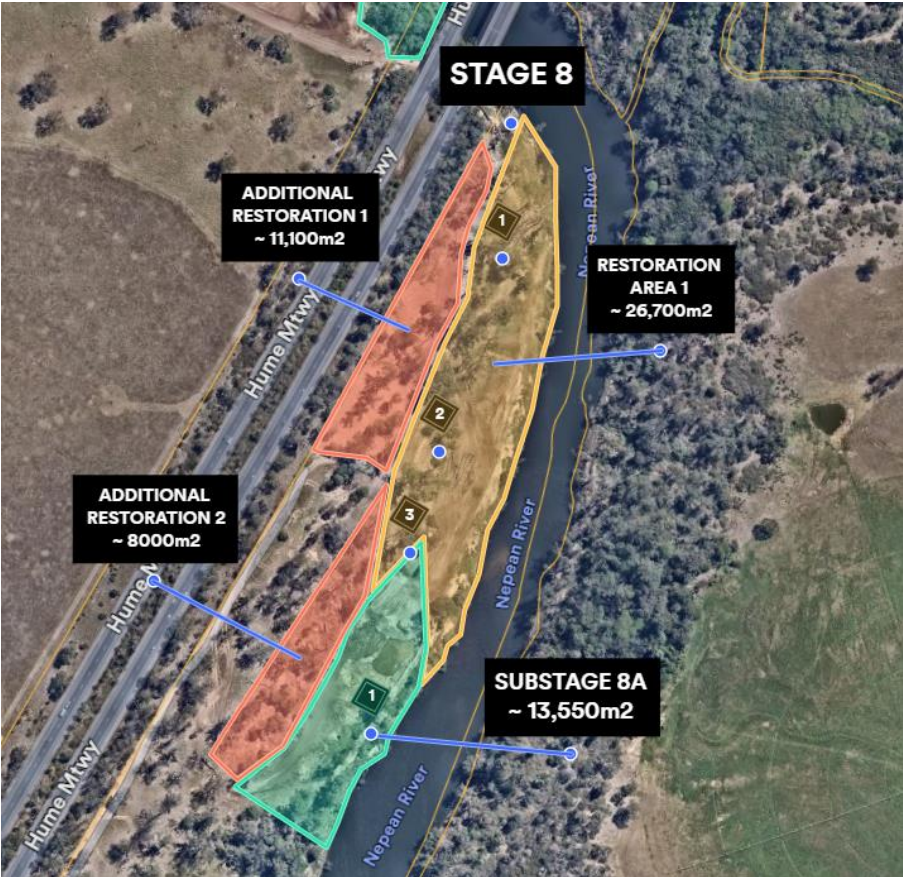


FIGURE 4. Stage 7 Restoration Area with five Vegetation Monitoring Plot locations and two Additional Restoration Areas

STAGE 8



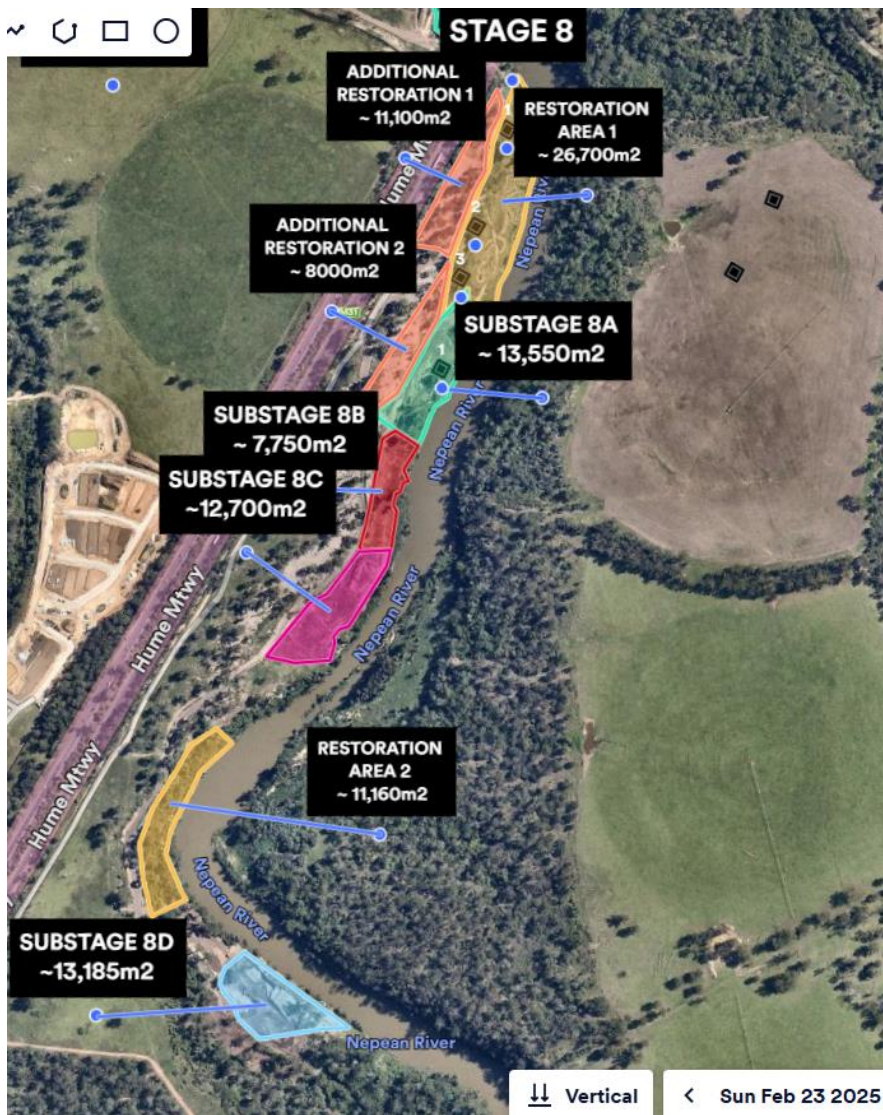


FIGURE 5. Stage 8 Restoration and Rehabilitation Areas at end 2024



FIGURE 6. Restoration Area 1 - Vegetation Restoration Monitoring Plot 1 (2024)



FIGURE 6A. Restoration Area 1 - Vegetation Restoration Monitoring Plot 1 (2025)



FIGURE 6B. Restoration Area 1 – 6 x Vegetation Clumps – long stem and seedling planting (2024/25)



FIGURE 7. Restoration Area 1 - Vegetation Restoration Monitoring Plot 2 (2024)



FIGURE 7A. Restoration Area 1 - Vegetation Restoration Monitoring Plot 2 (2025)



FIGURE 8. Restoration Area 1 - Vegetation Restoration Monitoring Plot 3



FIGURE 8. Restoration Area 1 - Vegetation Restoration Monitoring Plot 3 (2025)

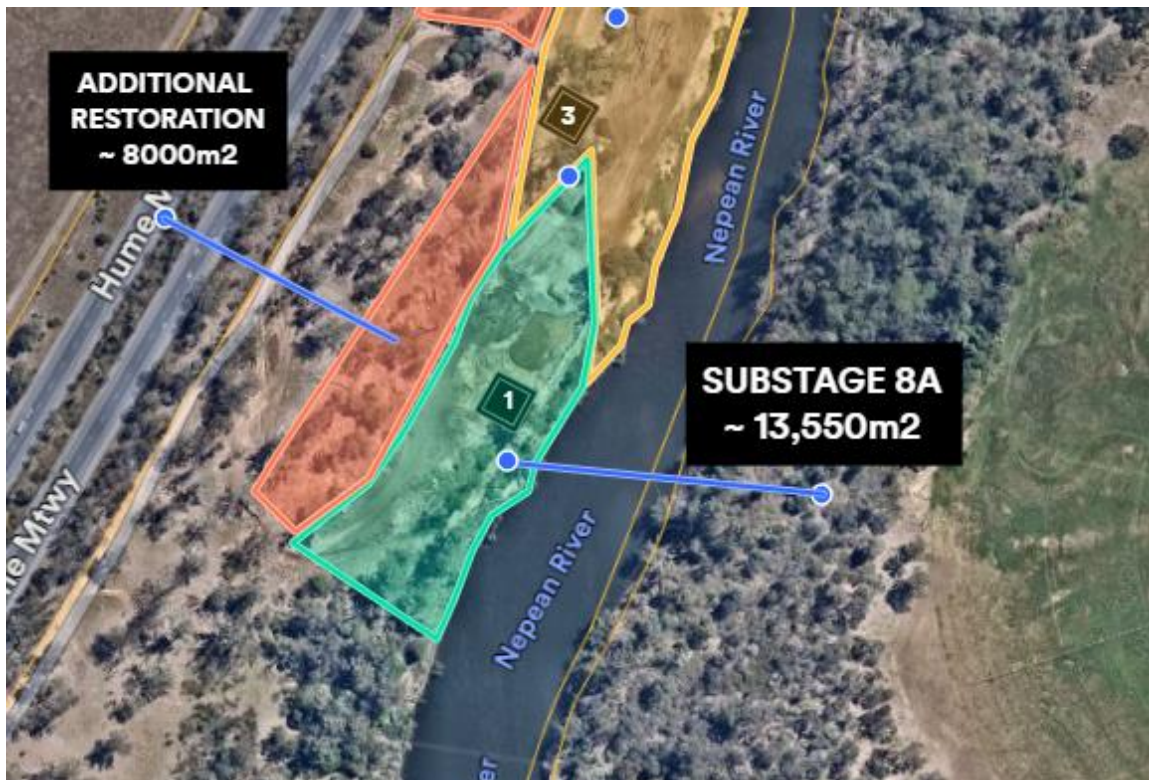


FIGURE 9. Substage 8A Restoration Area with one Vegetation Restoration Monitoring Plot location



FIGURE 10. Substage 8A Vegetation Restoration Monitoring Plot 1 (2024)



FIGURE 10A. Substage 8A Vegetation Restoration Monitoring Plot 1 (2025)



FIGURE 10B. Substage 8A - 6 x Vegetation Clumps – Long Stem and Seedling Planting (2024/25)



FIGURE 11B. Substage 8B - 4 x Vegetation Clumps – Long Stem and Seedling Planting (2024/25)



FIGURE 12B. Substage 8C – 5 x Vegetation Clumps – Long Stem and Seedling Planting (2024/25)

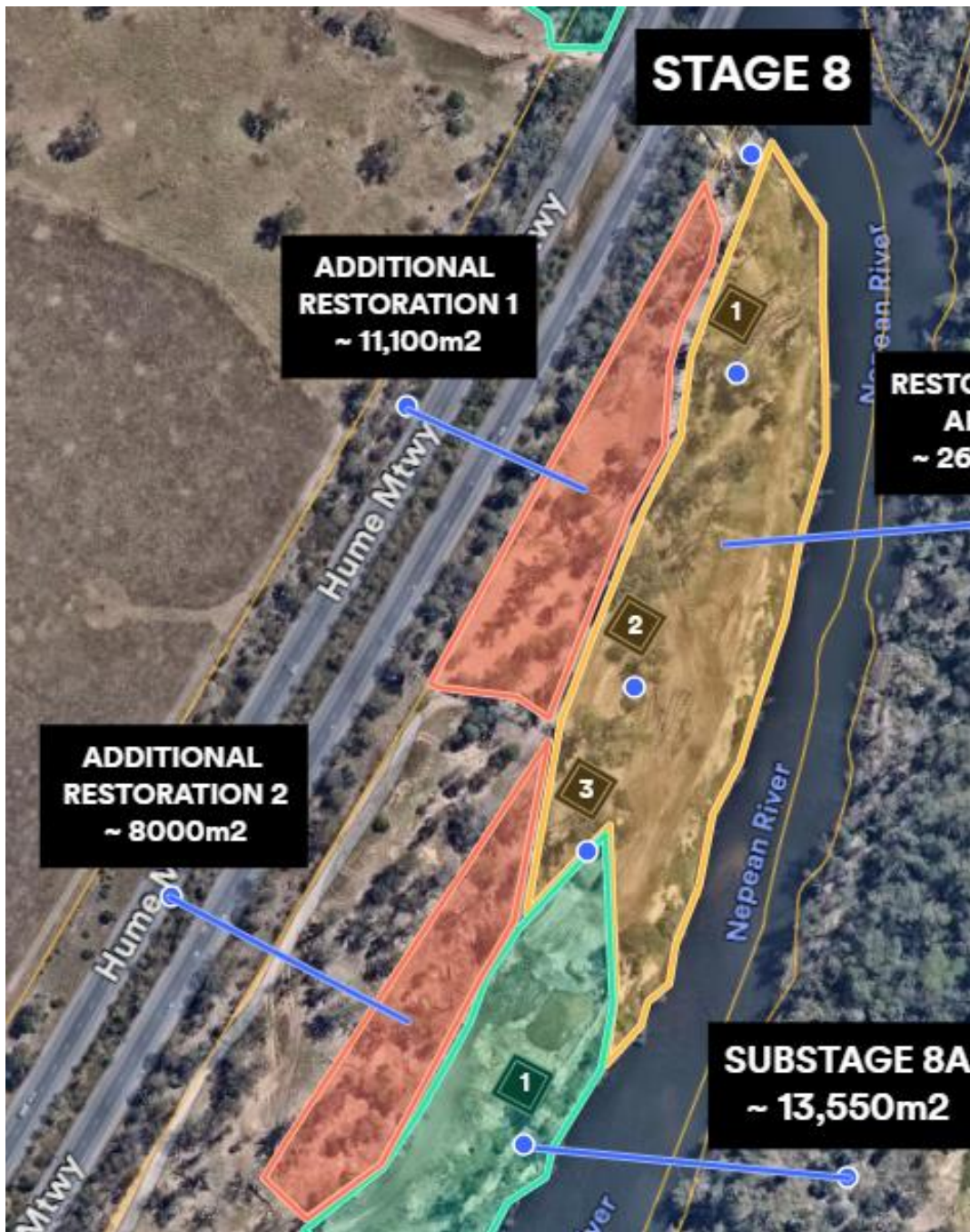


FIGURE 13. Stage 8 Additional Restoration Areas

MSS has restored additional areas in the Stage 8 area (see Figures 3,4 & 5) as part of its genuine commitment to successful rehabilitation of the extraction.

It has identified that the adjoining, mainly Lantana-infested areas would re-invade restored areas and the use of excessive amounts of weed-poisons would need to be employed. Therefore, MSS has undertaken additional areas of weed removal by stripping the weed mass (but leaving the eucalypts) and surface soils and burying them and then mulching the area. The areas are then improved by sparsely planting additional Koala food tree species from the species listed in Section 2.3. The mulching and slashing strategies will be reviewed as a matter of course.

These additional restoration areas represent a 71% increase in the restored area that is not required by the Consent.

3 Biodiversity management measures

3.1 Introduction

Biodiversity rehabilitation and restoration completion/performance indicators are provided in BRMP Table 8.2. Management actions in the reporting period, progress towards meeting the criteria, the effectiveness of management actions, progressive improvements and actions in the next reporting period are summarised below.

The biodiversity offsets management actions are provided in Section 3.2 and Attachment D of the BRMP.

3.2 Management actions, performance/completion criteria, observations and effectiveness

A summary of actions, performance/completion criteria, observations and effectiveness is provided in the table below.

The results of detailed floristic monitoring are described in the 2024 Floristic Monitoring Report provided in 0 and are summarised in the table below.

There were two Nepean River flood events that occurred during the 2024 Annual Review period that have had a significant impact on the success and progress rehabilitation and restoration efforts. Significant flooding occurred in the catchment area on the 6th April 2024 and again on the 6th June 2024 that eliminated and damaged rehabilitation planting and seeding from 2023 and early 2024 as well as left a silt residue over significant areas that also brought with it weeds and other debris from further up the catchment. The nett impact of this has been to review the methodology and establish a more effective way to restore the vegetation and being able to tolerate and survive increasing flood events in the future. Reference to the impacts will be included in the summary below as well as photos of the typical damage incurred. An independent assessment of the rehabilitation methodology was conducted in October 2024 by Urban Agronomy & Soil Science. The report titled Menangle Sand and Soil – Stage 8 Extraction Area Changes to the Rehabilitation Methodology October 2024 is now included in this report as an Attachment H.

Biodiversity rehabilitation and restoration summary							
Management actions	Performance/completion criteria	Progress against performance/completion criteria			Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)	Visual observations, monitoring results and trends	Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)
		Required completion year	Anticipated/actual completion year	Action completed (Yes/No)			
SUBSTAGE 8 - Vegetation establishment for soil stabilisation							
Initial planting/seeding for soil stabilisation	SUBSTAGE 8A area Vegetation established to stabilise soils in Substage 8A area substages that have been completed: <ul style="list-style-type: none">Native species from HN526 at one per square metre or greater. Or <ul style="list-style-type: none">Initial cover crop with 70% cover.	2022	2024	Yes both	The start of extraction had been delayed until Sept 2023, delaying Substage 8A planting/seeding. The area, post extraction, was Hydroseeded with the HN526 seed mix plus a cover crop in Dec 2023 Floristic monitoring was completed in the Substage 8A plots in accordance with BRMP Section 8.4.1. Please see Ecologist Report in Attachment E	See 0 for details.	See 0 for details.
	SUBSTAGE 8B area	2024	2024	No	Extraction of the Substage 8B area commenced in Feb 2024	- Inhibited by two flood events in 2024	- Invested in long stem planting strategy to avoid flood damage

Biodiversity rehabilitation and restoration summary							
Management actions	Performance/completion criteria	Progress against performance/completion criteria			Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)	Visual observations, monitoring results and trends	Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)
		Required completion year	Anticipated/actual completion year	Action completed (Yes/No)			
	SUBSTAGE 8C area	2025	2025	No	Extraction commenced in April 2024	Inhibited by two flood events in 2024 See Attachment E for details	- Invested in long stem planting strategy to avoid flood damage See Attachment E for details
	Substage 8D area	2027	2025	No	Extraction commenced in October 2024 and is still being extracted	No Rehabilitation as yet	No Rehabilitation as yet
	RESTORATION AREA 1: Vegetation established to stabilise soils in area: <ul style="list-style-type: none">Native species from HN526 at one per square metre or greater. Or <ul style="list-style-type: none">Initial cover crop with 70% cover.	2023	2023	Yes	The area has been restored and Hydroseeded with HN526 species list. Floristic monitoring (see BRMP Section 8.4.1) in the Restoration Area 1 plots (see BRMP Figure 7.1).	See 0 for details.	See 0 for details.
	RESTORATION AREA 2:	2030	2030	No	Selective weed removal and replacement by hand due to the steepness of terrain and erosion protection and retention of native vegetation	Not commenced	Not commenced

Biodiversity rehabilitation and restoration summary							
Management actions	Performance/completion criteria	Progress against performance/completion criteria			Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)	Visual observations, monitoring results and trends	Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)
		Required completion year	Anticipated/actual completion year	Action completed (Yes/No)			
SUBSTAGE 8A - Area vegetation management							
SUBSTAGE 8A Vegetation management, including planting/seeding of native species.	Native plant species are characteristic of HN526. The vegetation structure is recognisable as, or is trending towards, HN526. Total foliage cover of species allocated to Tree (TG) growth form; Shrub (SG) growth form; Grass and Grasslike (GG) growth form; and Forb (FG) growth form are trending towards the benchmark ranges. See Attachment E for details.	2028	2028	No	Landform and soil stabilization Weed Management Hydroseeding Added woody debris Floristic sampling (see BRMP Section 8.4.1) in the Substage 8A plots (see BRMP Figure 7.1).	See 0 for details.	See 0 for details.
Vegetation management	Completion criteria: levels of ecosystem function have been established that demonstrate that the vegetation is self-sustaining or is trending towards self-sustainability. Performance indicators: <ul style="list-style-type: none">The cover and species richness of the	2033	2033	No	Landform and soil stabilization Weed Management Hydroseeding Added woody debris Floristic sampling (see BRMP Section 8.4.1) in the Substage 8A plots (see BRMP Figure 7.1).	See 0 for details.	See 0 for details.

Biodiversity rehabilitation and restoration summary							
Management actions	Performance/completion criteria	Progress against performance/completion criteria			Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)	Visual observations, monitoring results and trends	Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)
		Required completion year	Anticipated/actual completion year	Action completed (Yes/No)			
	groundcover is stable or increasing. <ul style="list-style-type: none"> Evidence of plant reproduction and regeneration is present. See 0 for details.						
SUBSTAGE 8B- Vegetation management							
SUBSTAGE 8B Vegetation management, including planting/seeding of native species.	As for Substage 8A area.	Initial planting: 2029 Completion: 2034	Initial planting: 2029 Completion: 2034	No	Extraction of the Substage 8B is yet to finish.	See Attachment E for details	See Attachment E for details
SUBSTAGE 8C - Vegetation management							
SUBSTAGE 8C Vegetation management, including planting/seeding of native species.	As for Substage 8A area.	Initial planting: 2030 Completion: 2035	Initial planting: 2024 Completion: 2029	No	Extraction of the Substage 8C commenced in April 2024.	See Attachment E for details	See Attachment E for details
SUBSTAGE 8D – Vegetation management							
SUBSTAGE 8D Vegetation management,		Initial planting: 2030	Initial planting: 2024	No	Extraction of the Substage 8D commenced in October 2024	See Attachment E for details	See Attachment E for details

Biodiversity rehabilitation and restoration summary							
Management actions	Performance/completion criteria	Progress against performance/completion criteria			Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)	Visual observations, monitoring results and trends	Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)
		Required completion year	Anticipated/actual completion year	Action completed (Yes/No)			
including planting/seeding of native species.		Completion: 2035	Completion: 2029				
RESTORATION AREA 1 - Vegetation management							
RESTORATION AREA 1 Vegetation management, including planting/seeding of native species.	Native plant species are characteristic of HN526. The vegetation structure is recognisable as, or is trending towards, HN526. Total foliage cover of species allocated to Tree (TG) growth form; Shrub (SG) growth form; Grass and Grasslike (GG) growth form; and Forb (FG) growth form are trending towards the benchmark ranges. See 0 for details.	2028	2028	No	Landform and soil stabilization Weed Management Hydroseeding Added woody debris. Floristic sampling (see BRMP Section 8.4.1) in Restoration Area 1 plots (see BRMP Figure 7.1).	See 0 for details.	See 0 for details.
Vegetation management	Completion criteria: levels of ecosystem function have been established that demonstrate that the vegetation is self-sustaining or is trending towards self-sustainability.	2033	2033	No	Floristic sampling (see BRMP Section 8.4.1) in the Restoration Area 1 (see BRMP Figure 7.1).	See 0 for details.	See 0 for details.

Biodiversity rehabilitation and restoration summary							
Management actions	Performance/completion criteria	Progress against performance/completion criteria			Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)	Visual observations, monitoring results and trends	Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)
		Required completion year	Anticipated/actual completion year	Action completed (Yes/No)			
	Performance indicators: <ul style="list-style-type: none"> The cover and species richness of the groundcover is stable or increasing. Evidence of plant reproduction and regeneration is present. See 0 for details.						
RESTORATION AREA 2 - Vegetation management							
RESTORATION AREA 2 Vegetation management, including hand weeding and planting/seeding of native species.	Native plant species are characteristic of HN526. The vegetation structure is recognisable as, or is trending towards, HN526. Total foliage cover of species allocated to Tree (TG) growth form; Shrub (SG) growth form; Grass and Grasslike (GG) growth form; and Forb (FG) growth form are trending towards the benchmark ranges. See Attachment E for details.	2036	2036	No	Landform and soil stabilization Weed Management Floristic sampling (see Attachment E	See Attachment E for details.	See Attachment E for details.

Biodiversity rehabilitation and restoration summary							
Management actions	Performance/completion criteria	Progress against performance/completion criteria			Description of management actions/monitoring in the reporting period (including where undertaken, any variations and the reasons for variation)	Visual observations, monitoring results and trends	Effectiveness of management actions, progressive improvements, and other comments (including reasons for non-completion)
		Required completion year	Anticipated/actual completion year	Action completed (Yes/No)			
Vegetation management	Completion criteria: levels of ecosystem function have been established that demonstrate that the new vegetation is self-sustaining or is trending towards self-sustainability. Performance indicators: <ul style="list-style-type: none">• The cover and species richness of the groundcover is stable or increasing.• Evidence of plant reproduction and regeneration is present. See 0 for details.	2036	2036	No	Floristic sampling (see Attachment E)	See Attachment E for details.	See Attachment E for details.

3.3 Additional commentary

N/A

3.4 Measures to be taken in the next 12 months

The rehabilitation practices will continue to be refined as results/successes/failures become more evident.

- Ongoing weed management in Restoration Area 1, Completed Substage 8A, 8B, 8C and soon to be completed Substage 8D
- Commence selective weed management in Restoration Area 2
- Monitoring soil stability and drainage – post flooding
- Ongoing Hydroseeding and monitoring of any infill requirements
- Adding longer woody debris in clump developments – utilise faster growing native shrubs and plant closer to the trunks. Anchor trunks to prevent flood movement
- Establishment of rehabilitation outside Monitoring Plots in all stages
- Monitoring, repairing and continue adding nest boxes
- Review Mulching strategies – application thicknesses
- Transition to long stem planting approach and review BRMP methodology with flood impacts imminent
- Continue with onsite nursery for growing long stemmed native trees
- Revise grass seeding mixes in relation to native content
- Review slashing methodology in relation to weed management

4 Weed monitoring report

4.1 Introduction

The quarry's weed management strategy aims to improve the vegetation community in the restoration area and to preventing the spread of weeds to the rehabilitation and restoration areas (see BRMP Section 5.5).

Weed species present within the quarry area in 2021 (ie prior to operations in the Stage 8 area) are listed in BRMP Table 4.1. There are extensive areas of Lantana (*Lantana camara*), Small-leaved Privet (*Ligustrum sinense*), and Broad-leaf Privet (*Ligustrum lucidum*) in the Stage 8 area.

Areas with a total weed cover of at least 10% are considered to be 'weed infested'. As of April 2021, the quarry areas could be mapped as a single weed infested. The closure criteria is to reduce 'high threat weeds' (HTW)¹ and 'priority weeds' is no more than 2%.

Lantana is considered to be a HTW under the *Biodiversity Assessment Method* and a priority weed in the *Greater Sydney Regional Strategic Weed Management Plan 2017–2022 - Revised July 2021* prepared by Local Land Services in partnership with the Greater Sydney Regional Weed Committee.

Privet is a weed of regional concern in the *Greater Sydney Regional Strategic Weed Management Plan 2017–2022 - Revised July 2021*.

A 'novel weed' species is defined in the BRMP as any exotic species not recorded in previous surveys of the area (BRMP Table 4.1).

It should be noted that the two flood events has made weed management very difficult in 2024 due to foreign soils and weed material being carried on to site by the floods.

4.2 Management actions

The following weed management activities were completed in the reporting period:

- Campaign weed spraying and hand removal.
- Continual Slashing
- Mulching methods were employed to minimise weed re-emergence.
- Long stemmed planting of mature natives

4.3 Records

Weeds monitoring results within the plots are provided in Appendix A of Attachment E.

Please refer to Attachment E. Weed monitoring and mapping was also undertaken in restoration management areas within the quarry site, targeting the presence and coverage of Lantana, Privet, and novel weed species as described in Section 2.2. The weed monitoring results are presented in Table 3.2 and mapped in Figure 3.5 and Figure 3.6. Areas not surveyed are not included in the figures provided. Two species previously recorded in project vegetation surveys, Balloon Vine (*Cardiospermum grandiflorum*) and Trad (*Tradescantia fluminensis*) were observed to have established dense infestations in select areas of the site. As these species have been previously recorded in project vegetation surveys they do not qualify as novel weed species under the BRMP. Nonetheless, management of these species is recommended (Section 3.2.4).

¹ Called 'high threat exotics (HTE)' in the BRMP.

4.4 Progress against performance and completion criteria

2024 Progress against weed performance and completion criteria is summarised in detail in **Error! Reference source not found..**

Weed	Coverage last year (ha)	Coverage this year (ha)	% change	Requirement met? (Yes/No)
Lantana (<i>Lantana camara</i>)	0.58	0.44	-25	No
Small-leaved Privet (<i>Ligustrum sinense</i>)	0.41	0.46	+12	No
Broad-leaf Privet (<i>Ligustrum lucidum</i>)				

Notes: Management of Restoration Area 2 has not commenced and is not included in these results.

4.5 Annual trends

The weed monitoring shows marginal change in lantana and privet coverage since 2024 (Figure 3.5 and 3.6 in Attachment E)

4.6 Effectiveness of weed management measures

In general, the rehabilitation and restoration areas of the site are heavily impacted by ongoing weed invasion or recruitment. As identified in Section 1, flooding has occurred throughout all Stages and has deposited soil throughout. As such, the availability of weed propagules has increased significantly has reduced efficacy of management measures. Whilst two species previously recorded in project vegetation surveys (Balloon Vine and Trad) were observed to have established dense infestations in select areas of the site, these species do not qualify as novel weed species as were also observed during the BRMP surveys. However, due to the invasiveness of both species and observed prevalence on site they have therefore been identified as additional priority weed species to be managed as part of weed control efforts.

4.7 Measures to be taken in the next 12 months

Continued investment in the long stem planting approach and cultivating larger and older native plant stock on site. Mulching methodology will be reviewed, and vigilance will be ongoing as the infestations require 7 to 8 efforts to rid. As the quarry rehabilitation face has grown immensely in just 12 months the focus on weed management will be a priority

5 Nest box and woody debris report

5.1 Nest boxes

5.1.1 Introduction

Since April 2023, 44 nest boxes have been installed in the restoration areas adjacent to Stages 8A to 8D as described in BRMP Section 7.5.1. These nest boxes have been installed in three campaigns by a licensed arborist, as safe access and weather have permitted.

- September 2023
- January 2024
- March 2025

The nest box locations are shown in Attachment G

5.1.2 Management actions

Nest boxes are periodically checked following the following significant weather events to ensure that they are present and remain suitable for use by the target species:

- January 2024
- April 2024 (post flood)
- June 2024 (post flood)
- 18th November (usage observations)

On January 10th, 2024, a representative sample of nest boxes (8 nest boxes) were visually monitored using a manlift for recent signs of habitation (e.g. animal sightings). Thus far only 3 boxes were used by birds and no mammal habitation was suspected.

On Monday 18th November 2024 a representative sample of nest boxes (30 nest boxes) were visually checked and monitored for signs of habitation. Two of the possum boxes showed signs of use as were four of the bird/bat boxes. No sign of the owl boxes being used.

5.1.3 Records

Nest box locations, inspection records are provided in 0.

5.1.4 Progress against performance and completion criteria

Nest box performance is summarised below.

Nest box performance summary			
Nest box type	Number to be installed	Number functional/used	Percentage functional (%)
Double chamber microbat	40	2	4
Brushtail/ringtail possum, front entry	30	2	5

Nest box performance summary			
Nest box type	Number to be installed	Number functional/used	Percentage functional (%)
Sugar/squirrel, rear entry	30	2	5
Large owl	6	0	0
Total	106	6	5.7

5.1.5 Annual trends

There has been a small rise in nest box usage – The trends here will possibly increase as the quarrying and rehabilitation activities move farther along the site and there is less activity. Too early to assess

5.1.6 Measures to be taken in the next 12 months.

We will continue to install and monitor nest boxes 12 months before we enter a phase for extraction. It is important to note that to safely install all nest boxes on all phases now requires substantial clearing, in many cases, years before the arrival of extraction.

5.2 Woody debris

5.2.1 Introduction

As described in BRMP Section 7.5.2, woody debris and habitat materials (e.g. smaller branches and leave material) are placed on the Stage 8 substage rehabilitation and restoration areas. This action has been severely impacted by the two flood events and this type of light material is simply washed away. The large tree trunks generally survive but the best and most appropriate sourced material simply disappears and is often replaced with sand, silt and weed bearing material.

5.2.2 Management actions

Woody debris was placed in Restoration Area 1 and Extraction Substage 8A -8C during the reporting period. Commentary and recommendations on this aspect of the strategy are contained in Attachment E

There are no woody debris completion criteria conditioned for the Stage 6, Stage 7 or Restoration Area 1.

5.2.3 Measures to be taken in the next 12 months

Continue the rehabilitation program placement of woody debris of all sizes (but particularly large trunks) into rehabilitated extraction areas. This will be modified by the long stem planting approach shown in Attachment H

Continue to invest in the adaptive long stemmed planting approach and review the BRMP methodology to increase the rehabilitation effectiveness amongst a back drop of increasing significant flooding events affecting all stages of the site.

Attachment A

Drainage, erosion and sediment control inspections record

A.1 Drainage, erosion and sediment control inspections

Drainage, erosion and sediment control measures will be inspected in accordance with BRMP Table 8.1:

- weekly during normal operations hours;
- daily during periods of rainfall; and
- within 12 hours of the cessation of a rainfall event (greater than 10 mm) causing runoff to occur on, or from, the quarry.

Inspection date	Areas inspected	Observations					Notes	Management actions required
		Active erosion present? (Yes/No)	Number of rills/gullies	Cross-sectional area of rills/gullies	Sheet erosion present? (Yes/No)	Tunnel erosion present? (Yes/No)		
06/11/2023	Stage 8, Restoration Area 1	No	0	0	No	No	Approx 25mm rain recorded between the 29/10/23 - 5/11/23, Trees and guards not affected	As required
13/11/2023	Stage 8, Restoration Area 1	No	0	0	No	No	Approx 30mm rain recorded between the 29/10/23 - 5/11/23. Trees and guards not affected	
13/11/2023	Stages 6, 7	No	0	0	No	No	Approx 30mm rain recorded between the 29/10/23 - 5/11/23. Trees and guards not affected	

Inspection date	Areas inspected	Observations					Notes	Management actions required
		Active erosion present? (Yes/No)	Number of rills/gullies	Cross-sectional area of rills/gullies	Sheet erosion present? (Yes/No)	Tunnel erosion present? (Yes/No)		
4/12/2023	Stage 8, Restoration Area 1	No	1	Up to 5 m ²	No	No	Approx 59mm rain recorded between the 06/11/23 - 12/11/23. Slight gully formed in one area at the crest of batted Trees and guards not affected	Repaired, installed sediment control fence on top of batter
4/12/2023	Stages 6, 7	No	0	0	No	No	Approx 59mm rain recorded between the 06/11/23 - 12/11/23. No visual issues	
2/01/2024	Stage 8, Restoration Area 1	No	0	0	No	No	Approx 37mm rain recorded between the 18/12/23 - 24/12/23 & 63mm the between the 25/12/24 - 31/12/23. Sediment control fence on crest has eliminated rill/gullies Trees and guards not affected	
2/01/2024	Substage 8A,	No	0	0	No	No	Approx 37mm rain recorded between the 18/12/23 - 24/12/23 & 63mm the between the 25/12/24 -	

Inspection date	Areas inspected	Observations					Notes	Management actions required
		Active erosion present? (Yes/No)	Number of rills/gullies	Cross-sectional area of rills/gullies	Sheet erosion present? (Yes/No)	Tunnel erosion present? (Yes/No)		
							31/12/23. Sediment control fence on crest has eliminated rill/gullies Hydro mulching has eliminated rill/gullies	
2/01/2024	Stages 6, 7	No	0	0	No	No	Approx 37mm rain recorded between the 18/12/23 - 24/12/23 & 63mm the between the 25/12/24 - 31/12/23. No visual issues	
22/01/2024	Stage 8, Restoration Area 1	No	0	0	No	No	Approx 60mm rain recorded between the 14/01/24 - 21/1/2024 Trees and guards not affected	
22/01/2024	Substage 8A,	No	0	0	No	No	Approx 60mm rain recorded between the 14/01/24 - 21/1/2024 Sediment control fence on crest has eliminated rill/gullies Hydro mulching has eliminated rill/gullies	

Inspection date	Areas inspected	Observations					Notes	Management actions required
		Active erosion present? (Yes/No)	Number of rills/gullies	Cross-sectional area of rills/gullies	Sheet erosion present? (Yes/No)	Tunnel erosion present? (Yes/No)		
22/01/2024	Stages 6, 7	No	0	0	No	No	Approx 54mm rain recorded between the 14/01/24 - 21/1/2024 Trees and guards not affected No visual issues	
12/02/2024	Stage 8, Restoration Area 1	No	0	0	No	No	Approx 54mm rain recorded between the 5/02/24 - 11/2/2024 Trees and guards not affected	
12/02/2024	Substage 8A,	No	0	0	No	No	Approx 54mm rain recorded between the 5/02/24 - 11/2/2024Sediment control fence on crest has eliminated rill/gullies Hydro mulching has eliminated rill/gullies	
12/02/2024	Stages 6, 7	No	0	0	No	No	Approx 54mm rain recorded between the 5/02/24 - 11/2/2024Trees and guards where not affected No visual issues	

Inspection date	Areas inspected	Observations					Notes	Management actions required
		Active erosion present? (Yes/No)	Number of rills/gullies	Cross-sectional area of rills/gullies	Sheet erosion present? (Yes/No)	Tunnel erosion present? (Yes/No)		
18/3/24	Stage 8, Restoration Area 1	No	0	0	No	No	Approx 19mm rain recorded between the 15/03/24 - 17/3/2024, Trees and guards were not affected No visual issues	
18/3/24	Substage 8A,	No	0	0	No	No	Approx 19mm rain recorded between the 15/03/24 - 17/3/2024, Trees and guards were not affected No visual issues	
18/3/24	Stages 6, 7	No	0	0	No	No	Approx 19mm rain recorded between the 15/03/24 - 17/3/2024, Trees and guards were not affected No visual issues	
18/3/24	Substage 8B,	No	0	0	No	No	Approx 19mm rain recorded between the 15/03/24 - 17/3/2024, Trees and guards were not affected No visual issues	

Inspection date	Areas inspected	Observations					Notes	Management actions required
		Active erosion present? (Yes/No)	Number of rills/gullies	Cross-sectional area of rills/gullies	Sheet erosion present? (Yes/No)	Tunnel erosion present? (Yes/No)		
12/4/24	Stage 8, Restoration Area 1	No	0	0	No	No	Approx 175mm rain recorded between the 5/04/24 - 6/4/2024, <ul style="list-style-type: none"> some planted Seedlings missing heavy water logged with visual silt deposition over grass and planted area all trees guards washed away Cuttings of upper branches and seeds placed have been washed away with flood water 	
12/4/24	Substage 8A,	No	0	0	No	No	Approx 175mm rain recorded between the 5/04/24 - 6/4/2024, <ul style="list-style-type: none"> Heavy silt deposition approx. 20-30mm thick over the hydro 	

Inspection date	Areas inspected	Observations					Notes	Management actions required
		Active erosion present? (Yes/No)	Number of rills/gullies	Cross-sectional area of rills/gullies	Sheet erosion present? (Yes/No)	Tunnel erosion present? (Yes/No)		
							mulch/seed area over grass and planted area <ul style="list-style-type: none"> Habitat trees remained in place All planting covered and destroyed by silt deposition 	
12/4/24	Substage 8B,	Yes	0	1	No	No	Approx 175mm rain recorded between the 5/04/24 - 6/4/2024, <ul style="list-style-type: none"> Slight scouring of soil at the bottom of escarpment Heavy silt deposition approx. 20-30mm thick over the hydro mulch/seed area over grass and planted area Habitat trees remained in place 	Monitor and repair when area can be accessed

Inspection date	Areas inspected	Observations					Notes	Management actions required
		Active erosion present? (Yes/No)	Number of rills/gullies	Cross-sectional area of rills/gullies	Sheet erosion present? (Yes/No)	Tunnel erosion present? (Yes/No)		
							<ul style="list-style-type: none"> All planting covered and destroyed by silt deposition 	
12/4/24	Stages 6, 7	No	0	0	No	No	<ul style="list-style-type: none"> Stage 6 Restoration plot area water logged and covered with sand deposition from the flood Stage 7 Plat #5 covered with sand deposition from the flood Tree guards washed away 	Organize for are to be replanted in Stage 6 & 7
15/5/24	Stage 8, Restoration Area 1	No	0	0	No	No	<p>Approx 67mm rain recorded between the 4/05/24 - 12/5/2024,</p> <ul style="list-style-type: none"> No issues apart from area water logged 	

Inspection date	Areas inspected	Observations					Notes	Management actions required
		Active erosion present? (Yes/No)	Number of rills/gullies	Cross-sectional area of rills/gullies	Sheet erosion present? (Yes/No)	Tunnel erosion present? (Yes/No)		
15/5/24	Substage 8A,	No	0	0	No	No	Approx 67mm rain recorded between the 4/05/24 - 12/5/2024, <ul style="list-style-type: none"> Heavily water logged but no additional issues 	
15/5/24	Substage 8B,	No	0	0	No	No	Approx 67mm rain recorded between the 4/05/24 - 12/5/2024, <ul style="list-style-type: none"> Heavily water logged but no additional issues 	
15/5/24	Substage 8C,	No	0	0	No	No	Approx 67mm rain recorded between the 4/05/24 - 12/5/2024, <ul style="list-style-type: none"> Heavily water logged but no additional issues Newly installed silt fence intact 	

Inspection date	Areas inspected	Observations					Notes	Management actions required
		Active erosion present? (Yes/No)	Number of rills/gullies	Cross-sectional area of rills/gullies	Sheet erosion present? (Yes/No)	Tunnel erosion present? (Yes/No)		
15/5/24	Stages 6, 7	No	0	0	No	No	Approx 67mm rain recorded between the 4/05/24 - 12/5/2024, No issues	
14/6/24	Stage 8, Restoration Area 1	No	0	0	No	No	Approx 111mm rain recorded between the 6/06/24 – 8/6/2024, <ul style="list-style-type: none"> Habitat trees remained in place All replanting after April flood destroyed 	
14/6/24	Substage 8A,	No	0	0	No	No	Approx 111mm rain recorded between the 6/06/24 – 8/6/2024, <ul style="list-style-type: none"> Habitat trees remained in place All replanting after April flood destroyed 	

Inspection date	Areas inspected	Observations					Notes	Management actions required
		Active erosion present? (Yes/No)	Number of rills/gullies	Cross-sectional area of rills/gullies	Sheet erosion present? (Yes/No)	Tunnel erosion present? (Yes/No)		
14/6/24	Substage 8B,	No	0	0	No	No	Approx 111mm rain recorded between the 6/06/24 – 8/6/2024, <ul style="list-style-type: none"> Habitat trees remained in place All replanting after April flood destroyed No additional Scouring at the bottom of escarpment 	
14/6/24	Substage 8C,	No	0	0	No	No	Approx 111mm rain recorded between the 6/06/24 – 8/6/2024, <ul style="list-style-type: none"> Deposited sand covering part of silt fencing 	Repair section of silt fence

Inspection date	Areas inspected	Observations					Notes	Management actions required
		Active erosion present? (Yes/No)	Number of rills/gullies	Cross-sectional area of rills/gullies	Sheet erosion present? (Yes/No)	Tunnel erosion present? (Yes/No)		
14/6/24	Stages 6, 7	No	0	0	No	No	Approx 111mm rain recorded between the 6/06/24 – 8/6/2024, <ul style="list-style-type: none"> All replanting after April flood destroyed 	Replant trees again in stage 6 and 7
4/12/24	Stage 8, Restoration Area 1	No	0	0	No	No	Approx 46mm rain recorded between the 29/11/24 – 30/11/2024, <ul style="list-style-type: none"> Water logged however long stem planting looks successful 	
4/12/24	Substage 8A,	No	0	0	No	No		
4/12/24	Substage 8B,	No	0	0	No	No	Approx 46mm rain recorded between the 29/11/24 – 30/11/2024	

Inspection date	Areas inspected	Observations					Notes	Management actions required
		Active erosion present? (Yes/No)	Number of rills/gullies	Cross-sectional area of rills/gullies	Sheet erosion present? (Yes/No)	Tunnel erosion present? (Yes/No)		
							<ul style="list-style-type: none"> Water logged however long stem planting looks successful No additional Scouring at the bottom of escarpment 	
4/12/24	Substage 8C,	No	0	0	No	No	Approx 46mm rain recorded between the 29/11/24 – 30/11/2024, <ul style="list-style-type: none"> Water logged however long stem planting looks successful 	
4/12/24	Stages 6, 7	No	0	0	No	No	Approx 46mm rain recorded between the 29/11/24 – 30/11/2024, <ul style="list-style-type: none"> Water logged replanted trees look to be struggles with wet feet 	Review ground conditions and Replace trees

Attachment B

Initial soil condition indicators

B.1 Initial soil condition indicators

Soil samples were collected from the plots. Laboratory analytical reports for the reporting period are provided in Attachment B and summarised below.

Baseline soil performance indicators					
Parameter	Units	No. of samples	Results		
			Minimum	Maximum	Mean
pH in water (1:5 extraction)	-	11	6.05	7	6.64
Electrical conductivity (1:5 extraction)	dS/m	11	0.1	0.14	0.05
Cation exchange capacity	eCEC	11	3.1	16.4	9.04
Sodium	mg/kg	11	0.7	2	1.14
Organic matter	%	11	0.8	8	3.13
Phosphorus	mg/kg	11	5.2	64	14.24
Nitrate	mg/kg	11	<0.05	14	4.76
Aluminium	mg/kg	11	N/A	N/A	N/A
Magnesium	mg/kg	11	51	540	238

Sampling and analysis underway and to be reported in 2024 progress report.

Attachment C

Soil Chemistry Laboratory reports on initial Soil Conditions

Attachment D

Restoration Area 1 management summary

D.1 Biodiversity management actions in Restoration Area 1

The following biodiversity management actions were completed were completed in Restoration Area 1 in the reporting period 2023:

- Soil amelioration on the lower slopes
- Stabilisation and amelioration of the steeper slopes
- Seeding of native vegetation
- Erosion control measures
- Ongoing weed and pest control measures
- Established monitoring plots x 3 – marked out and sign posted.

D.2 Status of all biodiversity management actions in Restoration Area 1

The status of all biodiversity management actions in Restoration Area 1 funded by the Trust are summarised below.

Restoration Area 1 management actions summary																				
Management action	Year																			
	1*	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Soil amelioration (low slopes)	X	X	x																	
Stabilisation and soil amelioration (steep slopes)	X	X	x																	
Seeding native vegetation	X	X	x																	
Infill tubestock planting			X																	
Infill seeding			X																	
Erosion and sediment control maintenance	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Weed and pest control	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Planting maintenance 4 times/year			X	X	X	X	X													

Planting maintenance 2 times/year								X	X	X	X	X								
Planting maintenance 1 times/year													X	X	X	X	X	X	X	X
Fencing (installation)		X																		
Fencing (maintenance)		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Establish monitoring locations and formal annual monitoring audit	X	X																		
Inspections & monitoring - establishment phase		X	X	X	X	X														
Inspections & monitoring - RA1 ongoing							X	X	X	X	X	X	X	X	X	X	X	X	X	X
Annual report preparation		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
External review and audit		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

*Reporting period.

Legend

Management action required (X)
Required management action completed (C)
Required management action incomplete (IC)

Attachment E

Ecological Monitoring Report 2024:

Floristic plot data

Photo-point monitoring

Floristic monitoring assessment – Annual Performance

Weed mapping and monitoring

Attachment F

BRMP Planting Guidelines and Plant Species

Planting Guidelines

“The following vegetation establishment measures will be applied...:

- Weed control measures will be implemented. It is anticipated that several rounds of weed treatment will be needed prior to the native species in-fill planting.
- In areas of existing native vegetation, in-fill planting of native plant species will be undertaken to increase species diversity and to shade out weed species. Planting density will vary depending on the species’ growth types. Trees will be planted at a rate of 1 individual per 9 m², and mid-story/ground cover species at a rate of 1 individual per m². Plants that die will be replaced.
- In areas of exotic grass, seeding or in-fill planting of native plant species will be undertaken. Planting density will vary depending on the species’ growth types. Trees will be planted at a rate of 1 individual per 9 m², and mid-story/ground cover species at a rate of 1 individual per m². Plants that die will be replaced.

Species selection

Species targeted for native seed collection will focus on establishing the **40** key River-flat Eucalypt Forest EEC species listed in Table 5.1 [below], noting that River-flat Eucalypt Forest includes a wider range of species.

A rehabilitation and restoration criterion is the establishment of ≥24 species, across all Vegetation Restoration Monitoring Plots, that are aligned with the River Flat Eucalypt Forest EEC species list in the Final Determination.

Table 5.1 Plant species list

Tree (canopy layer)

Angophora floribunda	Rough-barked Apple
Angophora subvelutina	Broad-leaved Apple
Casuarina cunninghamiana subsp. cunninghamiana	River Oak
Casuarina glauca	Swamp Oak
Eucalyptus baueriana	Blue Box
Eucalyptus benthamii	Camden White Gum
Eucalyptus botryoides	Bangalay
Eucalyptus elata	River Peppermint
Eucalyptus saligna x botryoides	Southern Blue Gum
Eucalyptus tereticornis	Forest Red Gum
Melia azedarach	White Cedar

Small tree/shrub (mid-story layer)




Acacia floribunda	White Sally
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<i>Acacia parramattensis</i>	Parramatta Wattle
<i>Backhousia myrtifolia</i>	Grey Myrtle
<i>Breynia oblongifolia</i>	Coffee Bush
Grass/vine/rush/fern (ground layer)	
<i>Adiantum aethiopicum</i>	Maidenhair Fern
<i>Austrostipa ramosissima</i>	Stout Bamboo Grass
<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	Rock Fern
<i>Clematis aristata</i>	Old Man's Beard
<i>Commelina cyanea</i>	Native Wandering Jew
<i>Dichondra repens</i>	Kidney Weed
<i>Echinopogon ovatus</i>	Forest Hedgehog Grass
<i>Einadia hastada</i>	Saltbush
<i>Entolasia marginata</i>	Bordered Panic
<i>Entolasia stricta</i>	Wiry Panic
<i>Eustrephus latifolius</i>	Wombat Berry
<i>Glycine clandestina</i>	Twining glycine
<i>Lomandra filiformis</i>	Wattle Mat-rush
<i>Lomandra longifolia</i>	Spiny-headed Mat-rush
<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	Many-flowered Mat-rush
<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass
<i>Oplismenus aemulus</i>	Australian Basket Grass
<i>Plectranthus parviflorus</i>	Little Spurflower
<i>Poranthera microphylla</i>	Small Poranthera
<i>Pratia purpurascens</i>	Whiteroot
<i>Pteridium esculentum</i>	Bracken
<i>Sigesbeckia orientalis</i> subsp. <i>orientalis</i>	Indian Weed
<i>Solanum prinophyllum</i>	Forest Nightshade
<i>Themeda australis</i> / <i>Themeda triandra</i>	Kangaroo Grass
<i>Veronica plebeia</i>	Trailing Speedwe





Attachment G



Nest box Installation and monitoring records

E.1 Nest box installation



ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
B1	28/04/2023	Double chamber microbat	S 34.123541	E 150.754905		4m from ground level on trunk of a tree
B2	28/04/2023	Double chamber microbat	S34.123011	E 150.755194		Lower canopy 4-6m from ground level
B3	28/04/2023	Double chamber microbat	S 34.123127	E 150.755313		Lower canopy 4-6m from ground level




ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
B4	28/04/2023	Double chamber microbat	S 34.122137	E150.755434		In the tree canopy, on trunk or branch with relatively clear space to allow owls space for flight
B5	14/03/2024	Double chamber microbat	S 34.124704	E150.753927		Lower canopy 4-6m from ground level
B6	14/03/2024	Double chamber microbat	S 34.125381	E150.753367		Lower canopy 4-6m from ground level
B7	14/03/2024	Double chamber microbat	S 34.125811	E150.753249		Lower canopy 4-6m from ground level





ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
B8	14/03/2024	Double chamber microbat	S 34.126195	E150.752764		Lower canopy 4-6m from ground level
B9	14/03/2024	Double chamber microbat	S 34.127128	E150.753052		Lower canopy 4-6m from ground level
B10	14/03/2024	Double chamber microbat	S 34.127572	E150.753122		Lower canopy 4-6m from ground level
B11		Double chamber microbat	S 34.134088	E150.749923		Lower canopy 4-6m from ground level

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
B12		Double chamber microbat	S 34.134166	E150.749945		Lower canopy 4-6m from ground level
B13		Double chamber microbat	S 34.134600	E150.750408		Lower canopy 4-6m from ground level
B14		Double chamber microbat				
B15		Double chamber microbat				
B16		Double chamber microbat				
B17		Double chamber microbat				
B18		Double chamber microbat				
B19		Double chamber microbat				
B20		Double chamber microbat				
B21		Double chamber microbat				

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
B22		Double chamber microbat				
B23		Double chamber microbat				
B24		Double chamber microbat				
B25		Double chamber microbat				
B26		Double chamber microbat				
B27		Double chamber microbat				
B28		Double chamber microbat				
B29		Double chamber microbat				
B30		Double chamber microbat				
B31		Double chamber microbat				
B32		Double chamber microbat				
B33		Double chamber microbat				
B34		Double chamber microbat				





ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
B35		Double chamber microbat				
B36		Double chamber microbat				
B37		Double chamber microbat				
B38		Double chamber microbat				
B39		Double chamber microbat				
B40		Double chamber microbat				
LP101	28/04/2023	Brushtail/ringtail possum/front entry	S 34.122627	E 150.755569		Lower canopy 4-6m from ground level
LP102	28/04/2023	Brushtail/ringtail possum/front entry	S34.124020	E 150.754773		Lower canopy 4-6m from ground level




ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
LP103	28/04/2023	Brushtail/ringtail possum/front entry	S 34.122122	E 150.755462		Lower canopy 4-6m from ground level
LP104	1/02/2024	Brushtail/ringtail possum/front entry	S 34.07.6808	E 150.45.0971		Lower canopy 4-6m from ground level
LP105	1/02/2024	Brushtail/ringtail possum/front entry	S 34.07.7360	E 150.45.0035		Lower canopy 4-6m from ground level
LP106	1/02/2024	Brushtail/ringtail possum/front entry	S 34.07.7238	E 150.45.0528		Lower canopy 4-6m from ground level
LP107	1/02/2024	Brushtail/ringtail possum/front entry	S 34.07.7555	E 150.45.0005		

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
LP108	1/02/2024	Brushtail/ringtail possum/front entry	S 34.07.6529	E 150.45.1362		Lower canopy 4-6m from ground level
LP109	1/02/2024	Brushtail/ringtail possum/front entry	S 34.07.5307	E 150.45.2038		Lower canopy 4-6m from ground level
LP110	6/3/2025	Brushtail/ringtail possum/front entry	S 34.134410	E 150.75044		Lower canopy 4-6m from ground level
LP111	6/3/2025	Brushtail/ringtail possum/front entry	S 34.134137	E150.759971		Lower canopy 4-6m from ground level

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
LP112		Brushtail/ringtail possum/front entry				
LP113		Brushtail/ringtail possum/front entry				
LP114		Brushtail/ringtail possum/front entry				
LP115		Brushtail/ringtail possum/front entry				
LP116		Brushtail/ringtail possum/front entry				
LP117		Brushtail/ringtail possum/front entry				
LP118		Brushtail/ringtail possum/front entry				
LP119		Brushtail/ringtail possum/front entry				
LP120		Brushtail/ringtail possum/front entry				
LP121		Brushtail/ringtail possum/front entry				



ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
LP122		Brushtail/ringtail possum/front entry				
LP123		Brushtail/ringtail possum/front entry				
LP124		Brushtail/ringtail possum/front entry				
LP125		Brushtail/ringtail possum/front entry				
LP126		Brushtail/ringtail possum/front entry				
LP127		Brushtail/ringtail possum/front entry				
LP128		Brushtail/ringtail possum/front entry				
LP129		Brushtail/ringtail possum/front entry				
LP130		Brushtail/ringtail possum/front entry				


ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
SP201	28/04/2023	Sugar/squirrel/rear entry	S 34.123676	E 150.754609		Lower canopy 4-6m from ground level
SP202	28/04/2023	Sugar/squirrel/rear entry	S 34.122627	E 150.755365		Lower canopy 4-6m from ground level
SP203	28/04/2023	Sugar/squirrel/rear entry	S 34.12.3112	E 150.75.5300		Lower canopy 4-6m from ground level
SP204	1/02/2024	Sugar/squirrel/rear entry	S 34.07.6924	E 150.45.0697		Lower canopy 4-6m from ground level



ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
SP205	1/02/2024	Sugar/squirrel/rear entry	S 34.07.7881	E 150.44.9767		Lower canopy 4-6m from ground level
SP206	1/02/2024	Sugar/squirrel/rear entry	S 34.07.5181	E 150.45.2131		Lower canopy 4-6m from ground level
SP207	1/02/2024	Sugar/squirrel/rear entry	S 34.07.6300	E 150.45.1552		Lower canopy 4-6m from ground level

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
SP208	1/02/2024	Sugar/squirrel/rear entry	S 34.07.6688	E 150.45.1037		Lower canopy 4-6m from ground level
SP209	1/02/2024	Sugar/squirrel/rear entry	S 34.07.6150	E 150.45.1685		Lower canopy 4-6m from ground level
SP210	1/02/2024	Sugar/squirrel/rear entry	S 34.07.7029	E 150.45.0707		Lower canopy 4-6m from ground level
SP211	1/02/2024	Sugar/squirrel/rear entry	S 34.07.8068	E 150.44.9656		Lower canopy 4-6m from ground level

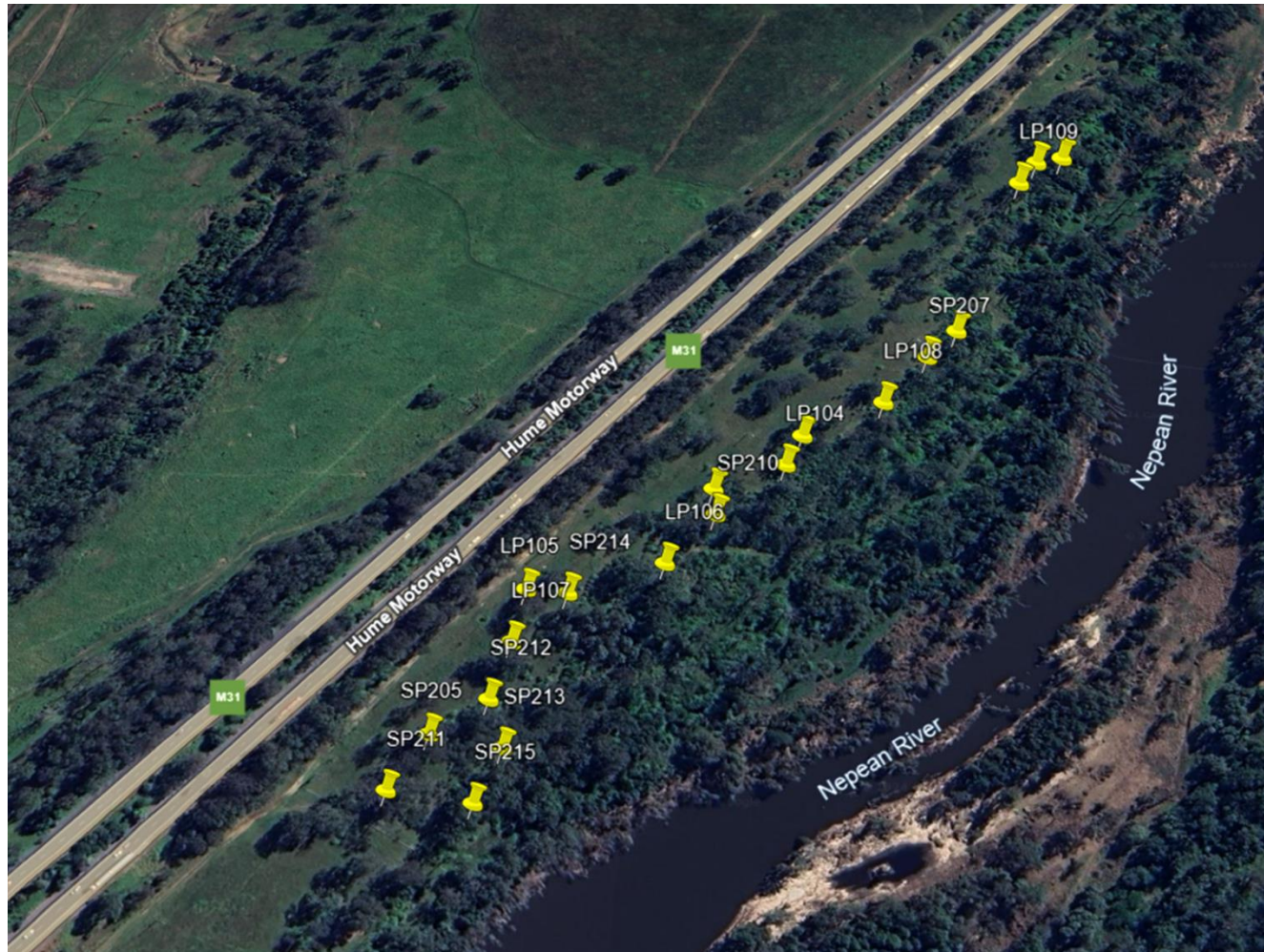
ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
SP212	1/02/2024	Sugar/squirrel/rear entry	S 34.07.7761	E 150.44.9953		Lower canopy 4-6m from ground level
SP213	1/02/2024	Sugar/squirrel/rear entry	S 34.07.7918	E 150.45.0017		Lower canopy 4-6m from ground level
SP214	1/02/2024	Sugar/squirrel/rear entry	S 34.07.7372	E 150.45.0185		Lower canopy 4-6m from ground level
SP215	1/02/2024	Sugar/squirrel/rear entry	S 34.07.8093	E 150.45.0185		Lower canopy 4-6m from ground level

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
SP216	6/3/2025	Sugar/squirrel/rear entry	S 34.134624	E 150.750432		Lower canopy 4-6m from ground level
SP217	6/03/2025	Sugar/squirrel/rear entry	S 34.134361	E 150.750180		Lower canopy 4-6m from ground level
SP218	6/03/2025	Sugar/squirrel/rear entry	S 34.134094	E 150.749926		Lower canopy 4-6m from ground level
SP219		Sugar/squirrel/rear entry				
SP220		Sugar/squirrel/rear entry				
SP221		Sugar/squirrel/rear entry				

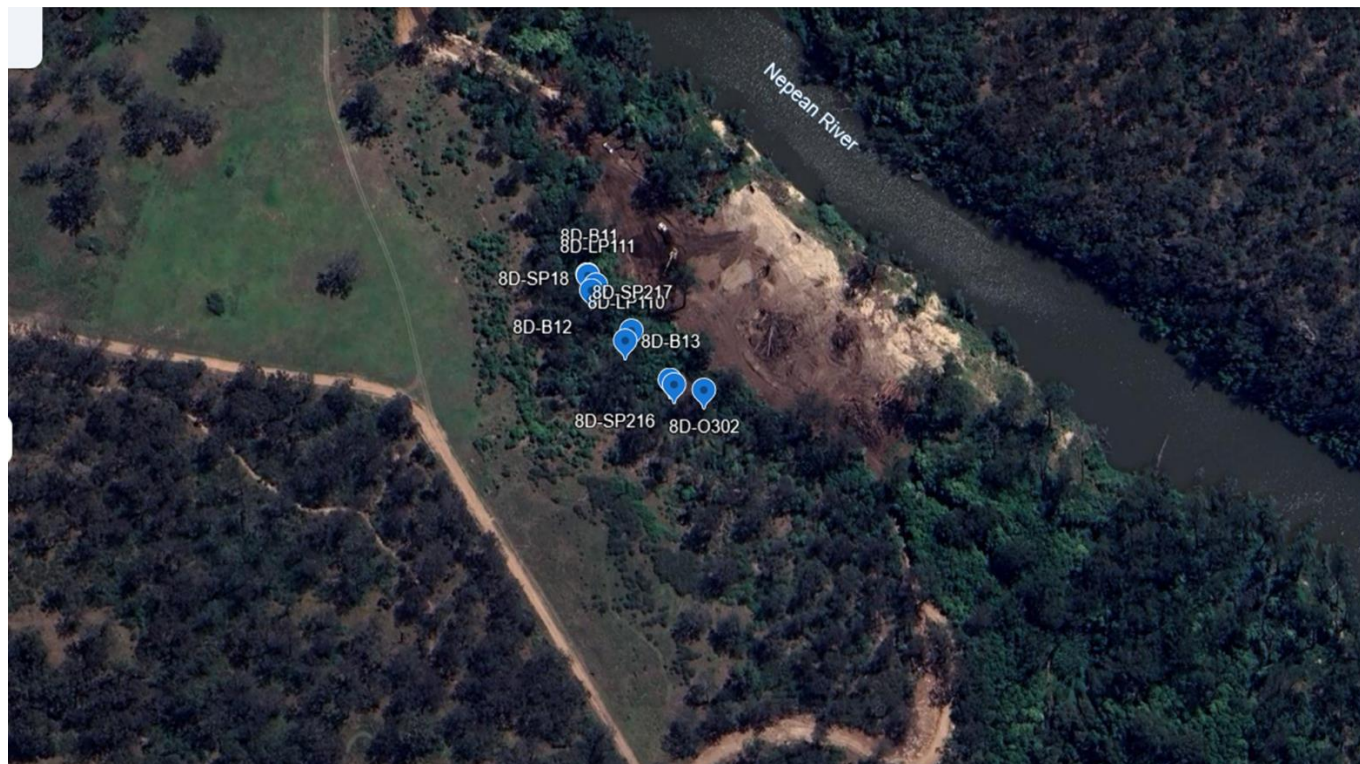
ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
SP222		Sugar/squirrel/rear entry				
SP223		Sugar/squirrel/rear entry				
SP224		Sugar/squirrel/rear entry				
SP225		Sugar/squirrel/rear entry				
SP226		Sugar/squirrel/rear entry				
SP227		Sugar/squirrel/rear entry				
SP228		Sugar/squirrel/rear entry				
SP229		Sugar/squirrel/rear entry				
SP230		Sugar/squirrel/rear entry				
O300	28/04/2023		S 34.12.2945	E 150.75.5201		Lower canopy 4-6m from ground level

ID number of Nestbox	Install Date	Nest box type	South	East	Tree Species	Location in tree
O301	1/02/2024	Large owl	S 34.07.5132	E 150.45.2256		Lower canopy 4-6m from ground level
O302	6/3/2025	Large owl	S 34.134094	E 150.749926		Lower canopy 4-6m from ground level
O303		Large owl				
O304		Large owl				
O305		Large owl				
O306		Large owl				

Nest box locations – Substages 8A, 8B and 8C



Nest box locations – Substage 8D



E.2 Nest box monitoring records

Representative nest box monitoring				
Date	Nest box ID	Functional? (Yes/No)	Condition description	Remediation actions required
10/1/24	LP103	N	Good – Signs of activity	Nil
10/1/24	B4	Y	Good – Signs of activity	Nil
10/1/24	O300	N	Good - Unused	Nil
10/1/24	SP202	N	Good - Unused	Nil
10/1/24	LP101	Y	Good – Signs of activity	Nil
10/1/24	B3	N	Good – Unused	Nil
10/1/24	B2	N	Good - Unused	Nil
10/1/24	SP203	N	Good – Unused	Nil
18/11/24	B2	Y	Good – Signs of activity	Nil
18/11/24	B3	Y	Unused	
18/11/24	B4	Y	Unused	
18/11/24	B5	Y	Unused	
18/11/24	B7	Y	Unused	
18/11/24	B8	Y	Unused	
18/11/24	B9	Y	Unused	
18/11/24	B10	Y	Good – Signs of activity	
18/11/24	LP101	Y	Unused	
18/11/24	LP102	Y	Unused	

Representative nest box monitoring				
18/11/24	LP103	Y	Unused	
18/11/24	LP104	Y	Unused	
18/11/24	LP105	Y	Unused	
18/11/24	LP106	Y	Unused	
18/11/24	LP107	Y	Unused	
18/11/24	LP108	Y	Good – Signs of activity	Lid repaired
18/11/24	LP109	Y	Good – Signs of activity	
18/11/24	O301	Y	Unused	
18/11/24	SP201	Y	Unused	
18/11/24	SP202	Y	Good – Signs of activity	
18/11/24	SP205	Y	Unused	
18/11/24	SP206	Y	Good – Signs of activity	
18/11/24	SP207	Y	Unused	
18/11/24	SP208	Y	Unused	
18/11/24	SP209	Y	Unused	
18/11/24	SP210	Y	Unused	
18/11/24	SP211	Y	Unused	
18/11/24	SP212	Y	Unused	
18/11/24	SP213	Y	Unused	
18/11/24	SP214	Y	Unused	

Attachment H

UASS -

Changes to the Rehabilitation Methodology

28 March 2025

Michael Holz
Quarry Manager
Menangle Sand and Soil Pty Ltd
31 Menangle Road
Menangle NSW 2568

Re: Menangle Sand and Soil Quarry - Review of BRMP monitoring reporting

Dear Michael,

1 Introduction

Menangle Sand and Soil Pty Ltd operates the Menangle Sand and Soil Quarry at 15 Menangle Road, Menangle. The quarry, located in the Wollondilly and Campbelltown local government areas, extracts sand and soil along the Nepean River as approved by Development Consent 85/2865.

Extraction in the Stage 8 area of the quarry commenced on 4 September 2023. Vegetation management and rehabilitation are conducted in accordance with the *Menangle Sand and Soil Biodiversity and Rehabilitation Management Plan* (version 3, EMM 2022) (BRMP) as approved by the Planning Secretary.

Section 8.8.2 of the BRMP requires that a Rehabilitation and Restoration Site Annual Progress Report is prepared.

Section 8.9 of the BRMP states that:

Annually, an ecologist will audit the monitoring described in this BRMP, either as part of the annual floristic monitoring program or as a separate activity. This will consist of auditing the results of monitoring of:

- landform establishment and stability assessment;
- growth medium development;
- weeds; and
- nest-box and woody debris.

This letter specifically reviews monitoring of these matters as presented in the *Rehabilitation and Restoration Site Annual Progress Report 01 January 2024 - 31 December 2024* (Menangle Sand and Soil Pty Ltd, March 2025).

To inform the report, a site inspection was undertaken by William Vile on 13 and 14 March 2025. This involved a rapid inspection of Stage 6, Stage 7, Stage 8A to 8C and Restoration Areas. Conditions on the days were fine, with 7 millimetres (mm) rainfall occurring over the night prior to the site inspection. Photographs are also presented in Appendix A to help document observations.

Rehabilitation/restoration is discussed in Section 2.2, growth medium development (applicable to Stages 6, 7 and 8) in Section 2.3, nestboxes (applicable to Stage 8) in Section 2.4, and woody debris (applicable to Stage 8) in Section 2.5.

2 Observations

2.1 Flooding background

The site has been subject to significant flooding in 2021, 2022 and 2024 due to high rainfall events. There were two significant floods in 2024 (April and June) which have presented ongoing difficulties in successful planting of native species and increased exotic species propagule exposure. The floods in 2024 covered the majority of Stage 6, Stage 7 and Substage 8 areas and have impeded rehabilitation efforts, impacting the quality of soil, retention of planted and hydroseed areas, and removed mulch and other woody debris from rehabilitation areas. The floods also deposited soil, weeds and other contaminants onto the site which will be dealt with as part of ongoing rehabilitation efforts. Menangle Sand and Soil have had to use adaptive measures and approaches for site rehabilitation.

2.2 Rehabilitation/restoration

Menangle Sand and Soil have undertaken substantial rehabilitation works at the quarry and commenced vegetation restoration works as required by the BRMP.

Resource extraction from Substage 8A, 8B and 8C was completed in March, May and July 2024, respectively. The first phase of rehabilitation, land-forming, is complete in these areas. The stabilisation, weed control and revegetation of these areas has commenced. See Table 2.1 for a summary of these details.

Table 2.1 Progress of extraction and rehabilitation

Management area	Extraction commenced	Extraction completed	Rehabilitation/ restoration commenced (Y/N)	Landform stabilised (as of March 2025) (Y/N)
Stage 6	August 2003	August 2007	Y	Y
Stage 7	August 2007	July 2019	Y	N (reshaping underway)
Restoration Area 1	N/A	N/A	Y	N/A
Substage 8A	September 2023	March 2024	Y	N
Substage 8B	March 2024	May 2024	Y	N
Substage 8C	May 2024	July 2024	Y	N
Substage 8D	November 2024	Extraction ongoing	N	N
Restoration Area 2	N/A	N/A	N	N/A

Recent rehabilitation works have included maintenance of rehabilitation in parts of the Stage 6, Stage 7 and Stage 8 areas. The early monitoring results described below will inform the wider additional rehabilitation of these areas.

Continued rehabilitation effort is evident in parts of the Stage 6, Stage 7 and Stage 8 areas. These works were significantly impacted by flooding of these areas in April and June of 2024.

Due to the ongoing flooding events, mortality of tube stock is evident throughout much of Stages 6, 7 and 8. As outlined in Attachment F of the Progress Report (MSS 2025), canopy species should be planted at a density of one individual per 9 square metres (m²), and mid-story/ground cover species at a rate of one individual per 1 m². Any planted individuals which die are to be replaced in consequent planting events. It is recommended that these values are considered during supplement long-stem tube stock planting events to ensure growth type densities are achieved.

As a response to flooding impacts, Menangle Sand and Soil have established an onsite plant nursery, which is used to supplement the long-stem tube stock used throughout the Restoration and Substage areas (Photograph A.1). The species utilised are consistent with the River Flat Eucalypt Forest and are shaded and watered weekly. The benefits of onsite storage of these supplementary species will increase the resiliency to local climatic variations and reduce the lag-time often associated with purchasing tube stock from external sources.

Substage 8D was observed to be undergoing extraction, and restoration or management of Restoration Area 2 was not commenced as of March 2025.

Due to ongoing changes within Management Zones, the monitoring plot locations do not coincide exactly with the monitoring plots in Figure 6.2 of the BRMP.

The early rehabilitation monitoring results provide an opportunity to refine some aspects of the program that will assist Menangle Sand and Soil to progressively rehabilitate the quarry to provide a native vegetation community along the Nepean River.

2.2.1 Stage 6 rehabilitation area

The Stage 6 rehabilitation area was initially established over 15 years ago. As part of establishing high-quality vegetation along the banks on the Nepean River, Menangle Sand and Soil have committed to reducing weed levels and enhancing native vegetation diversity in the Stage 6 rehabilitation area.

The landform appeared to be stable, with no signs of erosion visually observed.

It was observed that Plot 6.1 and Plot 6.2 had been regularly slashed and/or sprayed with herbicide since 2024, with exotic groundcover encroaching from outside of the plots (Photograph A.2 and Photograph A.3). No further planting or mulching had occurred within or adjacent to the plots in 2024.

It is understood that the Stage 6 area (as well as the other stages) experienced flooding in 2021, 2022 and twice in 2024 due to significant rainfall events. The floods have presented ongoing difficulties in successful planting of native species and increased exotic species propagule exposure. The floods in 2024 covered the majority of the Stage 6 area (Photograph A.4), which is likely to have contributed to the increased prevalence of exotic species within Plot 6.1 and Plot 6.2.

Moderate weed growth was observed in the remainder of the Stage 6 rehabilitation area (outside of the plots) where additional rehabilitation works, including weed control and seeding/planting, will be required to enhance the historical rehabilitation in this area. Furthermore, slashing and herbicide is not recommended to be the primary management methods for Stage 6, where native forbs and grasses will struggle to establish and persist. As a consequence of this, weed species are becoming established and may out-compete and smother natives. It is recommended that native species are established as early as possible across the Stage 6 restoration zone to assist in establishing River-Flat Eucalypt Forest in the long term.

2.2.2 Stage 7 rehabilitation area

The Stage 7 rehabilitation area continued in 2024, with no land-forming undertaken in 2024. Some revegetation works commenced in other parts of the Stage 7 rehabilitation area prior to 2023.

Menangle Sand and Soil have undertaken vegetation works with the establishment of five plots (Plots 7.1 to 7.5) within the Stage 7 rehabilitation area (Photograph A.5 to Photograph A.7). Revegetation works outside of these plots have not commenced.

Plot 7.1 and Plot 7.5 (at the western and eastern extent of the Stage 7 rehabilitation area, respectively) had a thick layer of mulch applied in 2023. From rapid visual inspection, no further planting or mulching had occurred within 2024. However, it was observed that some High-Threat Weeds (HTW) and Priority Weeds have established within these plots, and planted tube-stock have had high mortality rates. This is likely due to the absence of native ground cover species which are heavily suppressed by mulching techniques, and potentially by flooding. Restocking is required as outlined in Section 2.2 of this document.

Plots 7.2 to 7.4 are situated within the central part of the Stage 7 rehabilitation area, forming one continuous strip of regenerating vegetation. Continued revegetation success was observed in 2024 within these plots. It is understood that native seeds had been broad-cast by hand in 2022 after the floods, which is likely to have increased the resiliency of these plots.

It is understood that the Stage 7 area (as well as the other stages) also experienced flooding in 2021, 2022 and twice in 2024 due to significant rainfall events during the La Nina cycle. The floods have presented ongoing difficulties in successful planting of native species and increased exotic species propagule exposure as well as introducing sand, silt, soils with weed propagules and rubbish. The floods in 2024 covered the majority of the Stage 7 area (Photograph A.8), which is likely to have contributed to the increased prevalence of exotic species within Plot 7.1 and Plot 7.5.

Furthermore, slashing and herbicide is not recommended to be the primary management methods for Stage 7, where native forbs and grasses will struggle to establish and persist. As a consequence of this, weed species are becoming established and may out-compete and smother natives. It is recommended that native species are established as early as possible across the Stage 7 restoration zone to assist in establishing River-Flat Eucalypt Forest in the long term.

2.2.3 Stage 8 Restoration Area 1 and Substage 8A to 8C rehabilitation areas

The Stage 8 Restoration Area 1 provides biodiversity offsets for the Substage 8A to 8C extraction areas. Along with rehabilitation of the extraction area, Menangle Sand and Soil will restore River-Flat Eucalypt Forest in Restoration Area 1 to provide high-quality vegetation along the Nepean River. Additional Restoration Areas 1 and 2 are also established, which is not included in the BRMP and therefore a review is recommended.

Within Restoration Area 1 and Substage 8A to 8C, the landform was observed to have been established, and to be broadly stable, across these areas. Mulch and hydromulch was observed to have been applied to the upper-slope of the western embankment. Menangle Sand and Soil stated that hydromulch was applied to the lower slope of the western embankment, and that there had been a learning that a higher rate of application was required. We believe that whilst mulch will inhibit weeds, it will also likely inhibit some native plant growth, particularly from seed. Furthermore, the mulch utilized across the soil by Menangle Sand and Soil was observed to contain occasional foreign matter which may be attributed to flooding, consequently it is recommended that the mulching application strategy is reviewed.

Two monitoring plots, Plot 8B.1 and Plot 8C.1, respectively, were established within Substage 8B and 8C, respectively, to determine the long-term rehabilitation success of these Substages. The monitoring plots encompass areas where regeneration has commenced.

Exotic species were predominately removed from the Stage 8 Restoration Area 1 via scalping, and during resource extraction in Substage 8A to 8C. However, weeds were observed to have been re-established within these areas. Significant weed coverage was also visually observed within the Nepean River Buffer Zone (NRBZ) and lower riverbank, which is encroaching on the Restoration and Substage areas.

It is understood that the Stage 8 area (as well as the other stages) also experienced flooding in 2024 due to significant rainfall events. The floods in April and June of 2024 covered the majority of the Stage 8 area (Photograph A.9, Photograph A.10 and Photograph A.11), which is likely to have contributed to the increased prevalence of exotic species within the Stage 8 monitoring plots. These floods have also presented ongoing difficulties in successful planting of native species, where sediment deposition has resulted in burial or uprooting of planted individuals (Photograph A.12).

It was observed that Plot R8.1 and Plot R8.2 had been regularly mechanically slashed and/or sprayed with herbicide since 2024, which is evident by the presence of recently trimmed grass, dieback consistent with herbicide death and was in a condition inconsistent with the adjacent areas (Photograph A.13 and Photograph A.14, respectively). Plot R8.3 was not observed to be managed in the same way, however there was a higher occurrence of exotic species established within the plot.

As an adaptive management measure, long-stem tube stock was also introduced to Restoration Area 1 and Stage 8 to increase the efficacy of planting and success of rehabilitation. This method replaced the previously utilized method of planting tube stock, which had high attrition rates due to suffocation and inundation during flood events (Photograph A.12). This has resulted in greater success of establishment and persistence, which is evident throughout Restoration Area 1 and Substage 8A to 8C. The details of long-stem tube stock are outlined in the 'Stage 8 Extraction Area – Changes to the Rehabilitation Methodology' (UASS 2024) report which aimed to address the ongoing difficulties of rehabilitation/regeneration in a high-flow, flood-prone area. Menangle Sand and Soil stated that weekly watering had been undertaken to facilitate the successful acclimation of planted individuals. This supplementary action is likely to have significantly improved the efficacy of the long-stem tube stock method. Sowing native seed mix containing species characteristic of River-Flat Eucalypt Forest as per Table 5.1 of the BRMP is strongly recommended to continue, which will reduce opportunities for further weed establishment when accompanied by hand-removal weed control measures.

It is understood that broad-casting of native grass species has been applied to Plots 8A.1, 8B.1 and 8C.1, however exotic grass species have shown significant suppression of the success of this action. It is recommended that within the broader area, further supplementary plantings, or spreading cuttings (i.e. upper branches with leaves and seeds present) is undertaken. It should be noted that the spreading of cuttings has been significantly flood compromised as the material has been taken downstream. Furthermore, slashing and herbicide is not recommended to be the primary management methods for the Restoration and Substage areas, where native forbs and grasses will struggle to establish and persist. As a consequence of this, weed species are establishing and may out-compete and smother natives. It is recommended that native species are established as early as possible to assist in establishing River-Flat Eucalypt Forest in the long term.

Throughout 2024, significant scouring occurred within Substage 8A to 8C due to the flood events, removing portions of the hydromulch and mulch material on the lower slopes (Photograph A.15). This scouring has resulted in sporadic clumps of exotic species establishing on the entirety of the slope, significantly increasing risk to further scouring and exclusion of native species. It is recommended that planting of stabilising species such as *Casuarina cunninghamiana* subsp. *cunninghamiana* (River Oak), *Acacia floribunda* (White Sally) and other species consistent with the River-Flat Eucalypt Forest is undertaken to further stabilise the bank.

In addition, it was observed that additional lands had had treatment applied, with understorey removed, and mulch applied (Additional Restoration Areas 1 and 2 in the Progress Report). We understand that this was done for the purpose of preventing weeds spreading into Restoration Area 1. It is understood that Menangle Sand and Soil installed fencing around these areas in 2024. This controls accidental machinery access and prevents stock access. The Additional Restoration Areas have sporadic clumps of exotic species occurring, despite heavy mulching (Photograph A.16) and it is recommended that early intervention and manual treatment is undertaken.

This will reduce the subsequent effort required if pre-emptive rehabilitation is not undertaken in these areas. Exotic species loads are currently low, however there is minimal native species competition and exotic species are likely to establish a seed bank and potentially spread into the adjacent Restoration Area and Substage 8A to 8C.

A constructed drainage line is situated roughly on the boundary of Substage 8A/8B, which was observed to have a recent infestation of exotic species (Photograph A.17). The drainage line flows directly into the Nepean River, and therefore it is recommended that non-herbicide management techniques are used to selectively control exotic species within this drainage line.

The BRMP Progress Report (Menangle Sand and Soil 2024) states that Koala food tree species have been planted in the Stage 8 area. A number of these species do not occur in the local vegetation communities, and thus these plantings will lead to vegetation communities trending to modified vegetation communities, rather than the intended River-flat Eucalypt Forest. It is recommended that all planting within rehabilitation and identified restoration areas follow the species list provided in the BRMP. Koala food tree plantings can occur in the Koala tree planting zone in Stage 6 for supply of leaf cuttings to Symbio Zoo.

Restoration has not commenced in Restoration Area 2; however, it is recommended that Menangle Sand and Soil begin this process prior to completion of Substage 8D. The restoration area contains some exotic species; however, it is in a natural state and likely to respond well to hand-removal and scrape-paint treatment. Since Restoration Area 2 contains steep sections, successful management of weeds should be focused on the upper slopes, whilst accessing areas on lower to mid slope where applicable. It is not recommended that the same technique is utilized as seen in Additional Restoration Areas 1 and 2 (mulching and hydromulching), rather, less invasive techniques to allow native species to continue to persist and out-compete with the exotic species. Restoration Area 2 has a high potential to require minimal management if strategically undertaken. It is recommended that an adequately trained regeneration team is utilized for this process.

Extraction of Substage 8D has commenced, however it has not completed as of March 2025 and as such, not discussed in this report.

2.3 Growth medium development

Menangle Sand and Soil have collected soil samples in early 2024 from the plots and submitted to a laboratory for multi-nutrient analysis. These soil samples were collected 3 months after extraction completion of Substage 8B. As such, these soil samples were used as representatives within the 2024 and 2025 Progress Report. The laboratory reports (March 2024) are provided in Appendix C of the Progress Report. These samples form a good baseline for future soil monitoring. It is recommended that additional soil samples are collected and analysed from area(s) containing River Flat Eucalypt Forest as an indicator of any soil ameliorants required in the restoration and rehabilitation areas. Ideally these would be collected from areas of River Flat Eucalypt Forest in good condition, but it is unlikely that it will be possible to locate these, so it is recommended to take samples from the southern extent of the Stage 8 lot where River Flat Eucalypt Forest still occurs.

2.4 Nest boxes

Menangle Sand and Soil have commenced the installation of nest boxes (106 required in total). A number of these nestboxes were observed. It is understood that 44 have been installed to date.

Nestboxes are subject to weathering and fauna damage such as Brushtail Possums chewing on boxes. The nestboxes are constructed of marine-plywood and have been installed by a licenced arborist, as outlined in Section 7.5.1 of the BRMP. Monitoring of nestboxes to better ensure weathering and fauna damage is recommended on an ongoing basis. It is also recommended that the 'habisure' method of attachment (used by hollow log homes) is utilised. This consists of wire, which is bent into a concertina state, so that it can expand as the tree grows.

2.5 Woody debris

Large logs were observed to have been placed in both the restoration and rehabilitated extraction areas. Large logs have also been applied near the track edge close to the Hume Highway to prevent accidental machinery access to Restoration Area 1. Consideration should be given to extending the placement of logs at track edges to control vehicle movements. This is a positive action that will enhance the structural complexity and range of microhabitats present.

Woody debris would benefit with the application of supplementary thinner woody debris (branches/small logs). This could be resolved by adding branches from felled trees, including leaf and seed material that will assist with the re-establishment of species characteristic of River-Flat Eucalypt Forest.

Twenty-one (21) large logs have been placed throughout Restoration Area 1 and Stage 8 which have provided a microclimate for subsequent grass and forb growth (Photograph A.19). These logs act as an island/refuge for native species to establish and provide resiliency for environmental factors such as flooding. It is recommended that these logs are secured to further stabilise these features. Long-stem tube stock has been planted primarily surrounding these refuges to assist with successful planting.

3 Closing

The monitoring of landform establishment and stability; weeds; nest-box; woody debris and tube stock reported in the BRMP Progress Report (Menangle Sand and Soil 2024) corresponds with the observations made during the site inspection.

The new/additional rehabilitation in the Stage 6 and 7 areas commenced following approval of the extraction in the Stage 8 area. While rehabilitation was set back by flooding in 2021, 2022 and 2024, rehabilitation can be expanded within the broader Stage 6, 7 and 8 rehabilitation areas, informed by the successes (and failures) in the initial monitoring periods.

The Stage 8 extraction, restoration and rehabilitation program commenced in 2023 and has been subject to two major floods, limiting its success thus far.

There have been substantial restoration works in the Stage 8 Restoration Area 1 and rehabilitation works in the Substage 8A to 8C extraction areas. The volume (biomass) of large wood weeds, consisting of Lantana, Large-leaved Privet and Small-leaved Privet has been very substantially reduced, which is a positive outcome.

While in their early stages, the monitoring indicates that the use of thick mulch to suppress weeds appears to be also suppressing native vegetation growth and stability of soils so the mulching strategy should be amended.

Long-stem tube stock is being utilized as an adaptive management approach, responding to the ongoing difficulties associated with the flooding. This method is also supplemented by the placement of large logs, and hand-seeding which would be further improved by hand-removal of exotic species. On-site growth of tube stock is being utilized to supplement the long-stem tube stock method, increasing the efficacy of the planting occurring throughout the management areas.

It is strongly recommended that the use of appropriate native seed is substantially increased. The best results to date are observed where native seed was applied within monitoring Plots 7.2 to 7.4.

The quarry's early rehabilitation monitoring program results provide an opportunity to refine some aspects of the program that will assist Menangle Sand and Soil to progressively rehabilitate the quarry and establish high-quality vegetation community along the Nepean River.

Yours sincerely



William Vile

Ecologist

wvile@emmconsulting.com.au

References

EMM 2022, Biodiversity and Rehabilitation Management Plan, Report prepare for Menangle Sand and Soil.

Menangle Sand and Soil Pty Ltd 2025, Rehabilitation and Restoration Site Annual Progress Report. V1, Draft document dated 20/3/2025.

Urban Agronomy & Soil Science (UASS), Stage 8 Extraction Area – Changes to the Rehabilitation Methodology, Prepared for Menangle Sand and Soil.

Appendix A

Photographs



Photograph A.1 Onsite plant nursery for supplementary planting

A.1 Stage 6 area



Photograph A.2 Stage 6 Plot 6.1



Photograph A.3 **Stage 6 Plot 6.2**



Photograph A.4 **Flooding in Stage 6 positioned opposite side of river**

A.2 Stage 7 area



Photograph A.5 **Stage 7 Plot 7.1**



Photograph A.6 **Stage 7 Plot 7.2**



Photograph A.7 **Stage 7 Plot 7.2**



Photograph A.8 **Flooding in Stage 7 positioned opposite side of river, adjacent to non-vegetated area**

A.3 Stage 8 area



Photograph A.9 Stage 8 April 2024 flooding within Restoration Area 1 positioned in bottom right



Photograph A.10 Stage 8 April 2024 flooding within Substage 8B



Photograph A.11 **Stage 8 June 2024 flooding within Substage 8A**



Photograph A.12 **Stage 8 sediment deposit following flood**



Photograph A.13 Plot R8.1 evidence of slashing >90% of rehabilitation plot



Photograph A.14 Plot R8.2 evidence of slashing >50% of rehabilitation plot



Photograph A.15 **Stage 8 – Scouring and weed infestation**



Photograph A.16 **Additional Restoration Area example of exotic species establishing in mulch (*Conyza bonariensis*)**

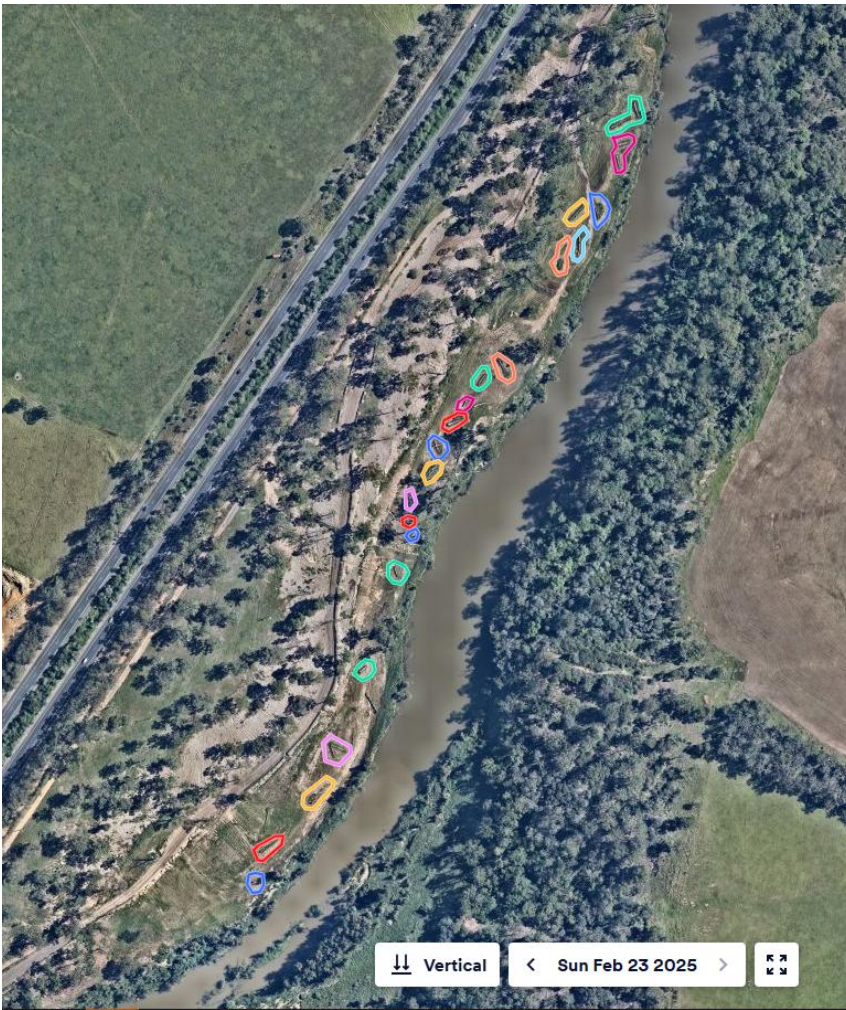


Photograph A.17 Stage 8A/8B drainage line with weed infestation

A.4 General observations



Photograph A.18 Nestbox LP108 requiring replacement



Photograph A.19 Location of large logs placed with associated long-stem tube stock planting (Photo supplied by Menangle Sand and Soil)

Ecological Monitoring

Menangle Sand and Soil Quarry

Prepared for Menangle Sand and Soil Pty Ltd

March 2025

Ecological Monitoring

Menangle Sand and Soil Quarry

Menangle Sand and Soil Pty Ltd

E190166 RP64

March 2025

Version	Date	Prepared by	Reviewed by	Comments
V1	25 March 2025	W. Vile	S. Ward	Draft
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Approved by



Steven Ward

Associate Director

28 March 2025

Level 3 175 Scott Street

Newcastle NSW 2300

ABN: 28 141 736 558

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1 Introduction

Menangle Sand and Soil Pty Ltd (Menangle Sand and Soil) operates the Menangle Sand and Soil Quarry ('the quarry') at 15 Menangle Road, Menangle. The quarry, located in the Wollondilly and Campbelltown local government areas, extracts sand and soil along the Nepean River as approved by Development Consent 85/2865 MOD2.

The Consolidated Consent ('the consent') allows the extraction of up to 150,000 tonnes per annum (tpa) of sand and soil from the approved Stage 8 area, which is about 13 hectares (ha) extending about 2 kilometres (km) along the Nepean River and divided into 13 separate sub-stages, designated sub-stage 8A to sub-stage 8M. As per condition B73 of the consent, a *Biodiversity and Rehabilitation Management Plan* (BRMP) (EMM, 2022) has been prepared for the quarry and governs the management of vegetation and clearing activities undertaken at the quarry site.

The landform within Domain 2 (Stage 6 and 7) has stabilised, however ongoing regeneration and monitoring is required to determine the efficacy of rehabilitation efforts.

Extraction in the Stage 8 area of the quarry commenced on 4 September 2023. At the time of this report, Substage 8A to 8C has been extracted and rehabilitation commenced. Extraction of Substage 8D commenced in February 2024, with no rehabilitation to date. Restoration Area 1 (within Stage 8) has commenced rehabilitation/regeneration activities, however these activities within Restoration Area 2 (within Stage 8) are yet to commence.

Significant flooding in 2021, 2022 and 2024 due to significant rainfall events have occurred at the site. There were two significant floods in 2024 (April and June) which have presented ongoing difficulties in successful planting of native species and increased exotic species propagule exposure. The floods in 2024 covered the majority of Stage 6, Stage 7 and Substage 8 areas and have impeded rehabilitation efforts, impacting the quality of soil, retention of planted and hydroseed areas, and removed mulch and other woody debris from rehabilitation areas. The floods also deposited soil, weeds and other contaminants onto the site which will be dealt with as part of ongoing rehabilitation efforts. Menangle Sand and Soil have had to use adaptive measures and approaches for site rehabilitation.

As an adaptive management measure, long-stem tube stock was also introduced to Restoration Area 1 and Stage 8 to increase the efficacy of planting and success of rehabilitation as a result of successive floods in April and June of 2024. This method replaced the previously utilized method of planting tube stock, which had high attrition rates due to suffocation and inundation during flood events. This has resulted in greater success of establishment and persistence, which is evident throughout Restoration Area 1 and Substage 8A–8C. The details of long-stem tube stock are outlined in the '*Stage 8 Extraction Area – Changes to the Rehabilitation Methodology*' (UASS 2024) report which aimed to address the ongoing difficulties of rehabilitation/regeneration in a high-flow, flood-prone area. Menangle Sand and Soil stated that weekly watering had been undertaken to facilitate the successful acclimation of planted individuals. This supplementary action is likely to have significantly improved the efficacy of the long-stem tube stock method. Sowing native seed mix containing species characteristic of River-Flat Eucalypt Forest as per Table 5.1 of the BRMP is strongly recommended to continue, which will reduce opportunities for further weed establishment when accompanied by hand-removal weed control measures.

The BRMP (Section 8.4) describes rehabilitation and restoration area monitoring that includes:

- floristic monitoring (BRMP Section 8.4.1)
- weed monitoring (BRMP Section 8.4.2).

EMM Consulting Pty Limited (EMM) was engaged by Menangle Sand and Soil to undertake this floristic and weed monitoring in March 2025.

2 Method

2.1 Floristic monitoring

Biodiversity restoration and rehabilitation outcomes are monitored annually using permanent 20-metre (m) by 20-m floristic plots quadrats in the restoration and rehabilitation areas. The following parameters are monitored in the plots:

- native species diversity
- tree, shrub, grass, and forb diversity and cover for both native and exotic species
- litter cover within five 1-square metre (m²) subplots within each 20 m by 20 m floristic plot
- photographic monitoring points
- regeneration of overstorey species.

The monitoring methods for each of these aspects are described in BRMP Section 8.4.

The locations of monitoring plots are shown in BRMP Figure 6.1 (Stage 6), BRMP Figure 6.2 (Stage 7), and BRMP Figure 7.1 (Substages 8A–8C). Menangle Sand and Soil have established initial rehabilitation plots in each of these areas, where rehabilitation is more advanced than in the surrounding areas (see Figure 2.1, Figure 2.2, Figure 2.3, Figure 2.4 and Figure 2.5 below). Due to ongoing changes in Management Zones, these plots are not in the same locations as identified within the BRMP.

The following plots were monitored:

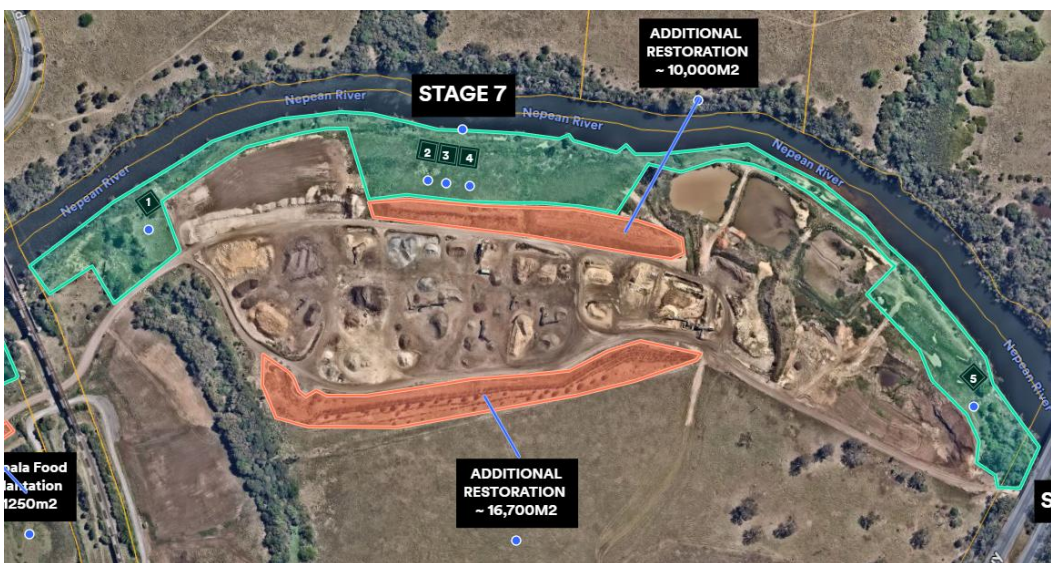
- Stage 6: Plot 6.1 and Plot 6.2.
- Stage 7: Plot 7.1, Plot 7.3 (as representative of Plots 7.2–7.4), and Plot 7.5.
- Stage 8A to 8C: Plot 8A.1, Plot 8B.1 and Plot 8C.1.
- Stage 8 Restoration Area 1: Plot 8R1.1 to Plot 8R1.3.

Floristic monitoring was undertaken by EMM ecologists William Vile and Luke Haeusler on 13–14 March 2025. Floristic monitoring was carried out within the plots, established and maintained by Menangle Sand and Soil to provide information on early rehabilitation progress in these areas.



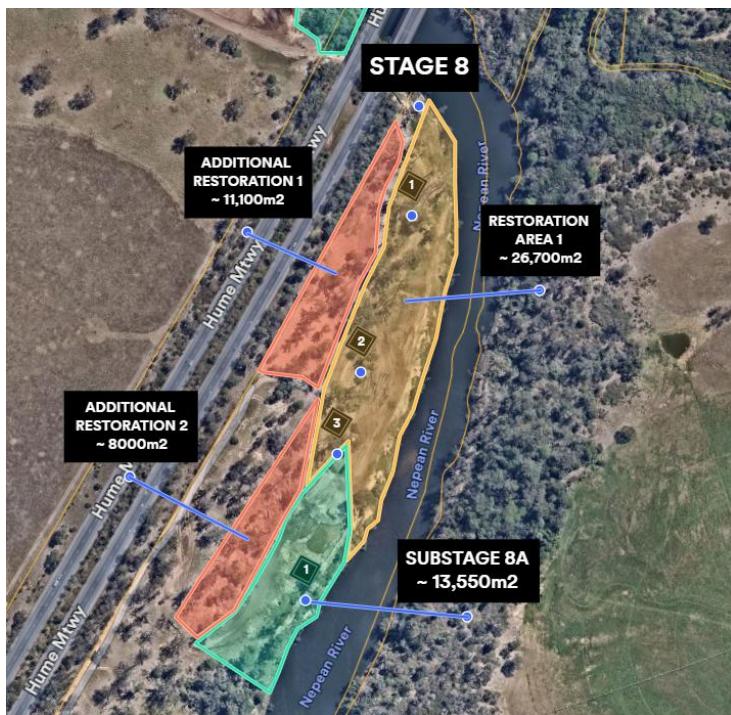
Source: Menangle and Soil.

Figure 2.1 Stage 6 area



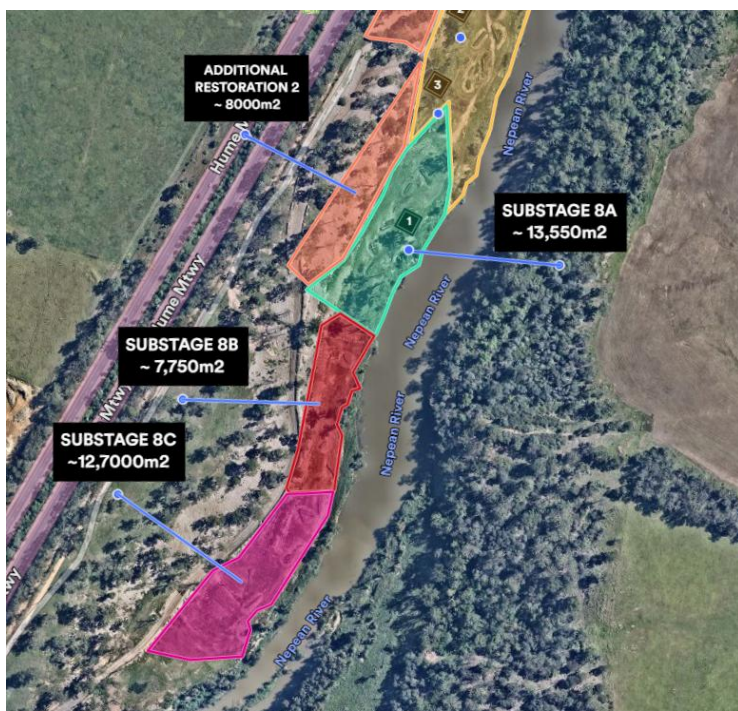
Source: Menangle and Soil.

Figure 2.2 Stage 7 area



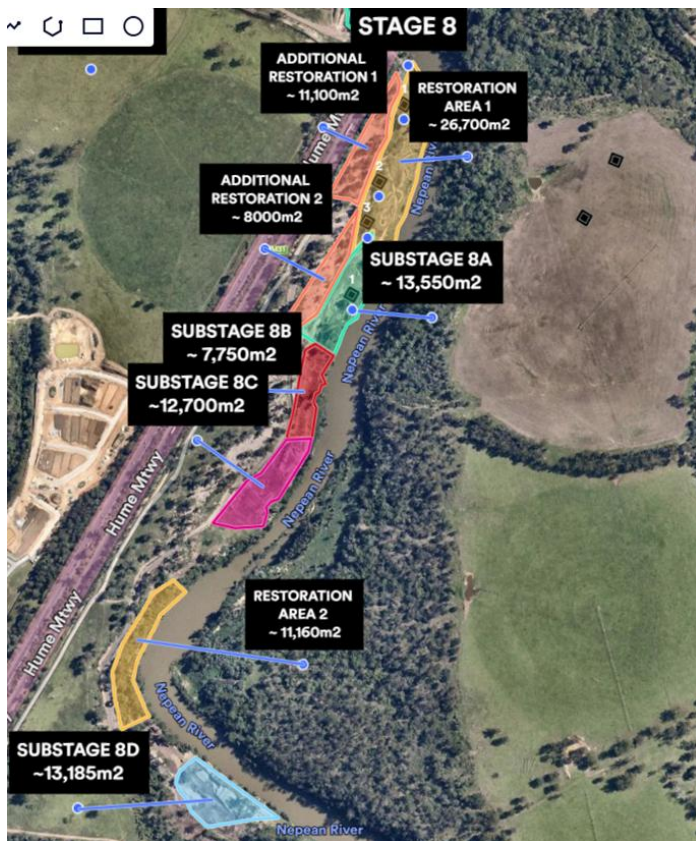
Source: Menangle and Soil.

Figure 2.3 Stage 8A, Restoration Area 1 and Stage 8 - Additional Restoration Areas 1 and 2



Source: Menangle and Soil.

Figure 2.4 Stage 8A to 8C



Source: Menangle and Soil.

Figure 2.5 Stage 8 area

2.2 Weed monitoring

EMM ecologist William Vile conducted the weed survey on 13–14 March 2025.

The survey was undertaken via walked transects at 20 m spacings across restoration and rehabilitation areas. Transect separation varied slightly where vegetation density and steep slope gradients impeded access.

Weed species were mapped via GPS recordings in field via point records (for infestations 1–25 m²), and polygon records for infestations greater than 25 m². Polygon records were recorded by walking the boundary of each infestation or estimated boundaries in the case of prohibited access by dense vegetation.

The weed monitoring survey primarily targeted the mapping of Lantana (*Lantana camara*), and Privet (*Ligustrum sinense* and *Ligustrum lucidum*). Observations of other weed species listed by the NSW Biodiversity Assessment Method (BAM) High Threat Weed (HTW) list were recorded to assess for weed species which are either new to the project or are forming/are likely to form a significant infestation within the project site.

Weed species which are new to the project site and likely to/are forming a significant infestation are classified as a 'novel weed species' and are included in the annual weed mapping program.

3 Results

3.1 Floristic monitoring

3.1.1 Floristic plot data

The floristic monitoring results are provided in Table 3.1.

Particularly in the Stage 8 area, the rehabilitation and restoration program has only recently commenced. The floristic monitoring indicates that up to 13 of the 24 target species characteristics of River-Flat Eucalypt Forest are present in any given monitoring plot. The early establishment of a greater number of River-Flat Eucalypt Forest species will greatly assist in the long-term development of a high-quality vegetation community throughout the regeneration/rehabilitation areas.

While a thick layer of mulch has been previously utilised to suppress weed growth, which appears to now be inhibiting the growth of species characteristic of River-Flat Eucalypt Forest.

It is recommended that the mulching and slashing strategy is modified to improve the establishment of River-Flat Eucalypt Forest species. This will be assisted by hand-removal and spraying of invasive species, supplemented by additional seeding or planting across the entirety of the restoration zones. The weed management regime will need to be modified as part of changing rehabilitation strategy.

Twenty-one (21) large logs have been placed throughout Restoration Area 1 and Stage 8 which have provided a microclimate for subsequent grass and forb growth. These logs act as an island/refuge for native species to establish and provide resiliency for environmental factors such as flooding. It is recommended that these logs are secured to further stabilize these features. Long-stem tube stock has been planted primarily surrounding these refuges to assist with successful planting. The extent of long-stem tube stock planting throughout Stage 8 and Restoration Area 1 is outlined in Figure 3.1, Figure 3.2, Figure 3.3 and Figure 3.4. Floristic data sheets are provided in Appendix A.

Table 3.1 Floristic monitoring results summary

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
Vegetation establishment for soil stabilisation in Stage 8 areas				
Initial planting/seeding for soil stabilisation	Substage 8A Vegetation established to stabilise soils in area: Native species from HN526 at one per square metre or greater. Or Initial cover crop with 70% cover.	<u>Extraction of Substage 8A was completed in March 2023</u> Native ground cover: Grass: 20.2% Forb: 0.4% Total: 20.6%	No	One plot has been established within the Substage 8A area. Evidence of hydromulch application to the area within the plot was observed. The total coverage of native ground cover calculated at 20.6%, which is a 17.1% increase from the previous year.
	Substage 8B area Vegetation established to stabilise soils in area: Native species from HN526 at one per square metre or greater. Or Initial cover crop with 70% cover.	<u>Extraction of Substage 8B was completed in May 2024</u> Plot 8B.1 has evidence of mulching having been undertaken. Native ground cover: Grass: 15.2% Forb: 0.4% Total: 15.6%	No	One plot has been established within the Substage 8B area. The total coverage of native ground cover calculated at 15.6%. As this survey constitutes as the first monitoring period, the current value of ground cover observed will serve as a benchmark for comparison and improvement upon in the following year.
	Substage 8C area Vegetation established to stabilise soils in area: Native species from HN526 at one per square metre or greater. Or Initial cover crop with 70% cover.	<u>Extraction of Substage 8C was completed in July 2024</u> Plot 8C.1 has evidence of mulching having been undertaken. Native ground cover: Grass: 10.1% Forb: 0.4% Total: 10.5%	No	One plot has been established within the Substage 8C area. Evidence of mulch application to the area within the plot was observed, with the total coverage of native ground cover calculated at 10.5%. As this survey constitutes as the first monitoring period, the current value of ground cover observed will serve as a benchmark for comparison and improvement upon in the following year.

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	Restoration Area 1 Vegetation established to stabilise soils in area: Native species from HN526 at one per square metre or greater. Or Initial cover crop with 70% cover.	<u>Plot 8R1.1</u> Evidence of slashing observed within plot. Native ground cover: Grass: 85% Forb: 2.2% Total: 87.7% <u>Plot 8R1.2</u> Evidence of slashing and weed spraying observed within plot. Native ground cover: Grass: 35% Forb: 5% Total: 40% <u>Plot 8R1.3</u> Evidence of weed spraying observed within plot. Native ground cover: Grass: 30% Forb: 0.1% Total: 30.1%	No	Three plots have been established within the Stage 8 restoration area. Evidence of tube stock planting was observed at all three plots, and hydromulch application observed at plot 8R1.1. The native ground cover has increased in all three monitoring plots; however, these values are skewed by the monoculture of <i>Cynodon dactylon</i> (Common couch) present throughout the management area. It is recommended that other native ground cover species are introduced to further improve the diversity, towards HN526 condition.

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
Stage 6 area rehabilitation vegetation management				
Vegetation management, including planting/seeding of native species in Substage 6 area	Native plant species are characteristic of HN526 as described in the Final Determination as demonstrated by the presence of a suitable number or proportion of ≥24 of the species listed in BRMP Table 5.1.	<p><u>Plot 6.1</u> Based on the floristic monitoring records (Appendix A), there are currently six species characteristic of HN526 within this plot area.</p> <p><u>Plot 6.2</u> Based on the floristic monitoring records (Appendix A), there are currently seven species characteristic of HN526 within this plot area.</p>	No	<p>Historical stock planting was undertaken in the plot areas, however further planting is required to increase the diversity diagnostic species.</p> <p>It is recommended that further planting (or seeding) of additional native species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.</p>

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	The vegetation structure is recognisable as, or is trending towards, the target Biometric Vegetation Type (BVT) HN526, which provides a suitable surrogate for River-flat Eucalypt Forest EEC.	<p><u>Plot 6.1</u></p> <p>Plot 6.1 was observed to have been historically established, with a soil-stabilising hydromulch applied and additional rehabilitation plantings have not taken place.</p> <p>Three HN526 canopy species were observed in the canopy layer. Total coverage of HN625 canopy species within the plot is calculated at 28%.</p> <p>One HN526 midstory species was observed within the plot, however it was a juvenile and was not functioning as a midstory species. Total coverage of HN526 midstory species within the plot is calculated at 0%.</p> <p>Two HN526 groundcover species were observed within the plot. Total coverage of HN526 groundcover species within the plot is calculated at 1.1%.</p> <p><u>Plot 6.2</u></p> <p>Plot 6.2 was observed to have been historically established, with a soil-stabilising hydromulch applied and additional rehabilitation plantings have not taken place.</p> <p>Three HN526 canopy species were observed at the canopy layer. Total coverage of HN625 canopy species within the plot is calculated at 25%.</p> <p>One HN526 midstory species was observed within the plot. Total coverage of HN526 midstory species within the plot is calculated at 15%.</p> <p>Two HN526 groundcover species were observed within the plot. Total coverage of HN526 groundcover species within the plot is calculated at 1.2%.</p>	No	<p>Historical stock planting was undertaken in the plot areas, however further planting is required to increase the diversity and cover of diagnostic species.</p> <p>It is recommended that further planting of additional native species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.</p>

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	Total foliage cover of species allocated to Tree (TG) growth form is trending towards the benchmark range of 27.5–32.5.	<u>Plot 6.1</u> Total foliage cover allocated to Tree Growth (TG) within plot 6.1 is 28%. <u>Plot 6.2</u> Total foliage cover allocated to Tree Growth (TG) within plot 6.2 is 25%.	No	Species counted towards TG are comprised of HN526 species only. It is recommended that planting of additional native canopy species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	Total foliage cover of species allocated to Shrub (SG) growth form is trending towards the benchmark range of 21–31.	<u>Plot 6.1</u> Total foliage cover allocated to Shrub Growth (SG) within plot 6.1 is 0.1%. <u>Plot 6.2</u> Total foliage cover allocated to Shrub Growth (SG) within plot 6.2 is 0.15%.	No	Species counted towards SG are comprised of HN526 species only. It is recommended that planting of additional native shrub layer species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	Total foliage cover of species allocated to Grass and Grasslike (GG) growth form is trending towards the benchmark range of 24.45–30.45.	<u>Plot 6.1</u> Total foliage cover allocated to Grass and Grasslike Growth (GG) within plot 6.1 is 1% <u>Plot 6.2</u> Total foliage cover allocated to Grass and Grasslike Growth (GG) within plot 6.2 is 1.2%	No	Species counted towards GG are comprised of HN526 species only. It is recommended that planting of additional native grass and grasslike species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	Total foliage cover of species allocated to Forb (FG) growth form is trending towards the benchmark range of 24.45–30.45.	<u>Plot 6.1</u> Total foliage cover allocated to Forb Growth (FG) within plot 6.1 is 0.1% <u>Plot 6.2</u> Total foliage cover allocated to Forb Growth (FG) within plot 6.2 is 0%	No	Species counted towards FG are comprised of HN526 species only. It is recommended that planting of additional native forb species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
Ongoing vegetation management	<p>Completion criteria: levels of ecosystem function have been established that demonstrate that the vegetation is self-sustaining or is trending towards self-sustainability.</p> <p>Performance indicators:</p> <p>The cover and species richness of the groundcover is stable or increasing.</p> <p>Evidence of plant reproduction and regeneration is present.</p>	<p><u>Plot 6.1</u></p> <p>Cover and species richness of native groundcover species within the plot is low.</p> <p>No second generation HN526 species were observed within the plot</p> <p><u>Plot 6.2</u></p> <p>Cover and species richness of native groundcover species within the plot is low.</p> <p>One second generation HN526 species (<i>Acacia parramattensis</i>) was observed within the plot.</p>	No	<p>Planting of native species has been undertaken within the plot.</p> <p>Future monitoring events will determine if reproduction is viable and will continue without intervention.</p>
	The cover and species richness of the groundcover, including grasses and forbs, is within the benchmark ranges.	<p><u>Plot 6.1</u></p> <p>Cover and species richness of native groundcover, including grasses and forbs was assessed to be outside the benchmark ranges.</p> <p><u>Plot 6.2</u></p> <p>Cover and species richness of native groundcover, including grasses and forbs was assessed to be outside the benchmark ranges.</p>	No	It is recommended that planting of native forb species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	Second generation individuals of shrubs and trees are present.	<p><u>Plot 6.1</u></p> <p>No second-generation species were observed within the plot.</p> <p><u>Plot 6.2</u></p> <p>Second generation species (<i>Acacia parramattensis</i>) were observed within the plot.</p>	No	It is recommended that mechanical slashing is not utilised in these plots to allow opportunity for second generation individuals to establish.
	Cover of 'high threat weeds' (HTW) and 'priority weeds' is no more than 2%.	<p><u>Plot 6.1</u></p> <p>Cover of HTW and priority weeds within the plot was assessed to be 7.5% coverage.</p> <p><u>Plot 6.2</u></p> <p>Cover of HTW and priority weeds within the plot was assessed to be 7.7% coverage.</p>	No	It is recommended that weed management measures are continued to reduce HTW and priority weed species presence within Substage 6.

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	Litter cover is within the benchmark range. There is no biometric benchmark, and thus the BAM benchmark of 40 for PCT835 is adopted.	<p><u>Plot 6.1</u></p> <p>Average litter cover was calculated from each five-set sub-plot assessed within Plot 6.1.</p> <p>Average litter cover: 90%</p> <p><u>Plot 6.2</u></p> <p>Average litter cover was calculated from each five-set sub-plot assessed within Plot 6.2.</p> <p>Average litter cover: 79%</p>	Yes	Litter cover is over BAM benchmark of 40. Mulch accounts for much of this value and is likely to decrease in cover in consequent monitoring events. It is recommended that fallen timber is left in-situ to sustain litter cover.
Stage 7 area rehabilitation vegetation management				
Vegetation management, including planting/seeding of native species in Substage 7 area.	Native plant species are characteristic of HN526 as described in the Final Determination as demonstrated by the presence of a suitable number or proportion of ≥24 of the species listed in BRMP Table 5.1.	<p><u>Plot 7.1</u></p> <p>Based on the floristic monitoring records (Appendix A), there are currently eight species characteristic of HN526 within this plot area.</p> <p><u>Plot 7.3 (indicative for 7.2 and 7.4)</u></p> <p>Based on the floristic monitoring records (Appendix A), there are currently five species characteristic of HN526 within this plot area.</p> <p><u>Plot 7.5</u></p> <p>Based on the floristic monitoring records (Appendix A), there are currently five species characteristic of HN526 within this plot area.</p>	No	<p>Historical tube stock planting was undertaken in this plot area.</p> <p>It is recommended that further seeding or planting of additional native species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.</p>

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	The vegetation structure is recognisable as, or is trending towards, the target Biometric Vegetation Type (BVT) HN526, which provides a suitable surrogate for River-flat Eucalypt Forest EEC.	<p><u>Plot 7.1</u></p> <p>Plot 7.1 was observed to have been historically established and additional rehabilitation plantings have not taken place.</p> <p>One HN526 canopy species was observed at the canopy layer (<i>Casuarina cunninghamiana</i> subsp. <i>cunninghamiana</i>) to comprise 15% coverage of the plot. Two other HN526 canopy species were also observed within the plot; however these species were observed as seedlings within the groundcover layer.</p> <p>Three HN526 midstory species were observed within the plot. Total coverage of HN526 midstory species within the plot is calculated at 20.2%.</p> <p>Two HN526 groundcover species were observed within the plot. Total coverage of HN526 groundcover species within the plot is calculated at 1.1%.</p> <p><u>Plot 7.3 (indicative for 7.2 and 7.4)</u></p> <p>Plot 7.3 was observed to have been historically established and additional rehabilitation plantings have not taken place.</p> <p>No HN526 canopy species were observed at the canopy layer of the plot. One HN526 canopy species (<i>Eucalyptus amplifolia</i>) was observed within the plot, however this species was observed as juveniles within the shrub layer.</p> <p>Two HN526 midstory species were observed within the plot. Total coverage of HN526 midstory species within the plot is calculated at 3%. One HN526 canopy species (<i>Eucalyptus amplifolia</i>) was observed within the shrub layer, with a cover of 20%.</p> <p>Two HN526 groundcover species were observed within the plot. Total coverage of HN526 groundcover species within the plot is calculated at 86%.</p>	No	<p>Tube stock planting was undertaken in this plot area, however further planting is required to increase the diversity and cover of diagnostic species.</p> <p>It is recommended that further seeding or planting of additional native species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.</p>

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
		<p><u>Plot 7.5</u></p> <p>Plot 7.5 was observed to have been historically established and additional rehabilitation plantings have not taken place.</p> <p>One HN526 canopy species were observed at the canopy layer (<i>Casuarina cunninghamiana subsp. cunninghamiana</i>) to comprise 15% coverage of the plot. Two other HN526 canopy species were also observed within the plot; however these species were observed as seedlings within the groundcover layer.</p> <p>Three HN526 midstory species were observed within the plot. Total coverage of HN526 midstory species within the plot is calculated at 20.2%.</p> <p>Two HN526 groundcover species were observed within the plot. Total coverage of HN526 groundcover species within the plot is calculated at 1.1%.</p>		
	Total foliage cover of species allocated to Tree (TG) growth form is trending towards the benchmark range of 27.5–32.5.	<p><u>Plot 7.1</u></p> <p>Total foliage cover allocated to Tree Growth (TG) within plot 7.1 is 15.2%.</p> <p><u>Plot 7.3 (indicative for 7.2 and 7.4)</u></p> <p>Total foliage cover allocated to Tree Growth (TG) within plot 7.3 is 20%.</p> <p><u>Plot 7.5</u></p> <p>Total foliage cover allocated to Tree Growth (TG) within plot 7.5 is 0.2%.</p>	No	<p>Species counted towards TG are comprised of HN526 species only.</p> <p>It is recommended that seeding or planting of additional native canopy species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.</p>

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	Total foliage cover of species allocated to Shrub (SG) growth form is trending towards the benchmark range of 21–31.	<p><u>Plot 7.1</u> Total foliage cover allocated to Shrub Growth (SG) within plot 7.1 is 20.2%.</p> <p><u>Plot 7.3 (indicative for 7.2 and 7.4)</u> Total foliage cover allocated to Shrub Growth (SG) within plot 7.3 is 3%.</p> <p><u>Plot 7.5</u> Total foliage cover allocated to Shrub Growth (SG) within plot 7.5 is 1.1%.</p>	No	<p>Species counted towards SG are comprised of HN526 species only.</p> <p>It is recommended that seeding or planting of additional native shrub layer species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.</p>
	Total foliage cover of species allocated to Grass and Grasslike (GG) growth form is trending towards the benchmark range of 24.45–30.45.	<p><u>Plot 7.1</u> Total foliage cover allocated to Grass and Grasslike Growth (GG) within plot 7.1 is 1%.</p> <p><u>Plot 7.3 (indicative for 7.2 and 7.4)</u> Total foliage cover allocated to Grass and Grasslike Growth (GG) within plot 7.3 is 86%.</p> <p><u>Plot 7.5</u> Total foliage cover allocated to Grass and Grasslike Growth (GG) within plot 7.5 is 80%.</p>	No	<p>Species counted towards GG are comprised of HN526 species only. The plots contain a high cover of one species <i>Cynodon dactylon</i> (Common couch), which should be supplemented with other native groundcovers to assist with successful rehabilitation.</p> <p>It is recommended that seeding or planting of additional native grass and grasslike species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.</p>
	Total foliage cover of species allocated to Forb (FG) growth form is trending towards the benchmark range of 24.45–30.45.	<p><u>Plot 7.1</u> Total foliage cover allocated to Forb Growth (FG) within plot 7.1 is 0.1%.</p> <p><u>Plot 7.3 (indicative for 7.2 and 7.4)</u> Total foliage cover allocated to Forb Growth (FG) within plot 7.3 is 0%.</p> <p><u>Plot 7.5</u> Total foliage cover allocated to Forb Growth (FG) within plot 7.5 is 0%.</p>	No	<p>Species counted towards FG are comprised of HN526 species only.</p> <p>It is recommended that seeding or planting of additional native forb species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.</p>

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
Ongoing vegetation management	<p>Completion criteria: levels of ecosystem function have been established that demonstrate that the vegetation is self-sustaining or is trending towards self-sustainability.</p> <p>Performance indicators: The cover and species richness of the groundcover is stable or increasing.</p> <p>Evidence of plant reproduction and regeneration is present.</p>	<p><u>Plot 7.1</u> Cover and species richness of native groundcover species within the plot is low. Second generation trees observed within Plot 7.1.</p> <p><u>Plot 7.3 (indicative for 7.2 and 7.4)</u> Cover and species richness of native groundcover species within the plot is low. Regeneration observed within Plot 7.2.</p> <p><u>Plot 7.5</u> Cover and species richness of native groundcover species within the plot is low. Regeneration not observed within Plot 7.3.</p>	No	<p>Planting of native species has been undertaken within the plot.</p> <p>Future monitoring events will determine if reproduction is viable and will continue without intervention.</p>
	The cover and species richness of the groundcover, including grasses and forbs, is within the benchmark ranges.	<p><u>Plot 7.1</u> Cover and species richness of native groundcover, including grasses and forbs was assessed to be outside the benchmark ranges.</p> <p><u>Plot 7.3 (indicative for 7.2 and 7.4)</u> Cover and species richness of native groundcover, including grasses and forbs was assessed to be outside the benchmark ranges.</p> <p><u>Plot 7.5</u> Cover and species richness of native groundcover, including grasses and forbs was assessed to be outside the benchmark ranges.</p>	No	It is recommended that seeding or planting of native forb species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	Second generation individuals of shrubs and trees are present.	<p><u>Plot 7.1</u> One second generation HN526 species (<i>Acacia parramattensis</i>) was observed within the plot.</p> <p><u>Plot 7.3 (indicative for 7.2 and 7.4)</u> No second-generation individuals were observed within the plot.</p> <p><u>Plot 7.5</u> No second-generation individuals were observed within the plot.</p>	No	It is recommended that mechanical slashing is not utilized in these plots to allow opportunity for second generation individuals to continue to establish.
	Cover of 'high threat weeds' (HTW) and 'priority weeds' is no more than 2%.	<p><u>Plot 7.1</u> Total HTW and priority weed coverage: 13.4%</p> <p><u>Plot 7.3 (indicative for 7.2 and 7.4)</u> Total HTW and priority weed coverage: 16.3%</p> <p><u>Plot 7.5</u> Total HTW and priority weed coverage: 11%</p>	No	It is recommended that weed management measures are continued to reduce HTW and priority weed species presence within Substage 8A.
	Litter cover is within the benchmark range. There is no biometric benchmark, and thus the BAM benchmark of 40 for PCT835 is adopted.	<p><u>Plot 7.1</u> Average litter cover: 52%</p> <p><u>Plot 7.3</u> Average litter cover: 2.2%</p> <p><u>Plot 7.5</u> Average litter cover: 58%</p>	No	Litter cover is trending towards the BAM benchmark of 40. It is recommended that fallen timber is left in-situ to allow for further increase of litter cover. Mulch accounts for much of this value and is likely to decrease in cover in consequent monitoring events. It is recommended that fallen timber is left in-situ to sustain litter cover.

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
Substage 8A area rehabilitation vegetation management				
Vegetation management, including planting/seeding of native species in Substage 8A area.	Native plant species are characteristic of HN526 as described in the Final Determination as demonstrated by the presence of a suitable number or proportion of ≥24 of the species listed in BRMP Table 5.1.	<u>Plot 8A.1</u> Based on the floristic monitoring records (Appendix A), there are currently 13 species characteristic of HN526 within this plot area.	No	This monitoring period constitutes the first monitoring event for these plots, therefore no prior years monitoring results are available to assess whether HN526 native plant species diversity within monitored plots is trending towards HN526. Tube stock planting was undertaken in this plot area. It is recommended that further planting of additional native species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	The vegetation structure is recognisable as, or is trending towards, the target Biometric Vegetation Type (BVT) HN526, which provides a suitable surrogate for River-flat Eucalypt Forest EEC.	<u>Plot 8A.1</u> Plot 8A.1 was observed to have recently been established, with a soil-stabilising hydromulch applied and additional rehabilitation plantings not having taken place. One HN526 canopy species were observed at the canopy layer (<i>Eucalyptus botryoides</i>) to comprise 10% coverage of the plot. One other HN526 canopy species was also observed within the plot (<i>Angophora floribunda</i>); however this species was observed as a seedling within the groundcover layer. Two HN526 midstory species were observed within the plot. Total coverage of HN526 midstory species within the plot is calculated at 0.4%. Seven HN526 groundcover species were observed within the plot. Total coverage of HN526 groundcover species within the plot is calculated at 20.4%.	No	Tube stock planting was historically undertaken in this plot area, however further seeding or planting is required to increase the diversity and cover of diagnostic species. It is recommended that further seeding or planting of additional native species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	Total foliage cover of species allocated to Tree (TG) growth form is trending towards the benchmark range of 27.5–32.5.	<u>Plot 8A.1</u> Total foliage cover allocated to Tree Growth (TG) within plot 8A.1 is 10.1%.	No	Species counted towards TG are comprised of HN526 species only. It is recommended that seeding or planting of additional native canopy species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	Total foliage cover of species allocated to Shrub (SG) growth form is trending towards the benchmark range of 21–31.	<u>Plot 8A.1</u> Total foliage cover allocated to Shrub Growth (SG) within plot 8A.1 is 0.4%.	No	Species counted towards SG are comprised of HN526 species only. It is recommended that seeding or planting of additional native shrub layer species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	Total foliage cover of species allocated to Grass and Grasslike (GG) growth form is trending towards the benchmark range of 24.45–30.45.	<u>Plot 8A.1</u> Total foliage cover allocated to Grass and Grasslike Growth (GG) within plot 8A.1 is 20.2%.	No	Species counted towards GG are comprised of HN526 species only. The plot contains a high cover of one species <i>Cynodon dactylon</i> (Common couch), which should be supplemented with other native groundcovers to assist with successful rehabilitation. It is recommended that seeding or planting of additional native grass and grasslike species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	Total foliage cover of species allocated to Forb (FG) growth form is trending towards the benchmark range of 24.45–30.45.	<u>Plot 8A.1</u> Total foliage cover allocated to Forb Growth (FG) within plot 8A.1 is 0.4%.	No	Species counted towards FG are comprised of HN526 species only. It is recommended that seeding or planting of additional native forb species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
Ongoing vegetation management	<p>Completion criteria: levels of ecosystem function have been established that demonstrate that the vegetation is self-sustaining or is trending towards self-sustainability.</p> <p>Performance indicators:</p> <p>The cover and species richness of the groundcover is stable or increasing.</p> <p>Evidence of plant reproduction and regeneration is present.</p>	<p><u>Plot 8A.1</u></p> <p>Cover and species richness of native groundcover species within the plot is low.</p> <p>Second generation <i>Hakea spp.</i>, <i>Acacia spp.</i> and <i>Eucalyptus spp.</i> were observed within the plot.</p>	No	<p>Planting of native species has been undertaken within the plot.</p> <p>Future monitoring events will determine if reproduction is viable and will continue without intervention.</p>
	The cover and species richness of the groundcover, including grasses and forbs, is within the benchmark ranges.	<p><u>Plot 8A.1</u></p> <p>Cover and species richness of native groundcover, including grasses and forbs was assessed to be outside the benchmark ranges.</p>	No	It is recommended that seeding or planting of native forb species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	Second generation individuals of shrubs and trees are present.	<p><u>Plot 8A.1</u></p> <p>Second generation <i>Hakea spp.</i>, <i>Acacia spp.</i> and <i>Eucalyptus spp.</i> were observed within the plot.</p>	Yes	It is recommended that mechanical slashing is not utilized in these plots to allow opportunity for second generation individuals to continue to establish.
	Cover of 'high threat weeds' (HTW) and 'priority weeds' is no more than 2%.	<p><u>Plot 8A.1</u></p> <p>Cover of HTW and priority weeds within the plot was assessed to be 9.7% coverage.</p>	No	It is recommended that weed management measures are continued to reduce HTW and priority weed species presence within Substage 8A.
	Litter cover is within the benchmark range. There is no biometric benchmark, and thus the BAM benchmark of 40 for PCT835 is adopted.	<p><u>Plot 8A.1</u></p> <p>Average litter cover was calculated from each five-set sub-plot assessed within Plot 8A.1.</p> <p>Average litter cover: 13%</p>	No	Litter cover is trending towards the BAM benchmark of 40. It is recommended that fallen timber is left in-situ to allow for further increase of litter cover.

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
Substage 8B area rehabilitation vegetation management				
Vegetation management, including planting/seeding of native species in Substage 8A area.	Native plant species are characteristic of HN526 as described in the Final Determination as demonstrated by the presence of a suitable number or proportion of ≥24 of the species listed in BRMP Table 5.1.	<u>Plot 8B.1</u> Based on the floristic monitoring records (Appendix A), there are currently 12 species characteristic of HN526 within this plot area.	No	This monitoring period constitutes the first monitoring event for these plots, therefore no prior years monitoring results are available to assess whether HN526 native plant species diversity within monitored plots is trending towards HN526. Tube stock planting was undertaken in this plot area. It is recommended that further seeding or planting of additional native species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	The vegetation structure is recognisable as, or is trending towards, the target Biometric Vegetation Type (BVT) HN526, which provides a suitable surrogate for River-flat Eucalypt Forest EEC.	<u>Plot 8B.1</u> Plot 8B.1 was observed to have recently been established, with a soil-stabilising hydromulch applied and rehabilitation plantings having taken place. One HN526 canopy species were observed at the canopy layer (<i>Eucalyptus botryoides</i>) to comprise 15% coverage of the plot. Two HN526 canopy species were also observed within the plot, however these species were observed as plantings within the groundcover layer. One HN526 midstory species (<i>Acacia floribunda</i>) was observed within the plot as a seedling within the groundcover layer. Four HN526 groundcover species were observed within the plot. Total coverage of HN526 groundcover species within the plot is calculated at 15.6%.	No	Tube stock planting was undertaken in this plot area, however further seeding or planting is required to increase the diversity and cover of diagnostic species. It is recommended that further planting of additional native species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	Total foliage cover of species allocated to Tree (TG) growth form is trending towards the benchmark range of 27.5–32.5.	<u>Plot 8B.1</u> Total foliage cover allocated to Tree Growth (TG) within plot 8B.1 is 15.3%.	No	Species counted towards TG are comprised of HN526 species only. It is recommended that seeding or planting of additional native canopy species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	Total foliage cover of species allocated to Shrub (SG) growth form is trending towards the benchmark range of 21–31.	<u>Plot 8B.1</u> Total foliage cover allocated to Shrub Growth (SG) within plot 8B.1 is 0.1%.	No	Species counted towards SG are comprised of HN526 species only. It is recommended that seeding or planting of additional native shrub layer species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	Total foliage cover of species allocated to Grass and Grasslike (GG) growth form is trending towards the benchmark range of 24.45–30.45.	<u>Plot 8B.1</u> Total foliage cover allocated to Grass and Grasslike Growth (GG) within Plot 8B.1 is 15.6%.	No	Species counted towards GG are comprised of HN526 species only. The plot contains a high cover of one species <i>Cynodon dactylon</i> (Common couch), which should be supplemented with other native groundcovers to assist with successful rehabilitation. It is recommended that seeding or planting of additional native grass and grasslike species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	Total foliage cover of species allocated to Forb (FG) growth form is trending towards the benchmark range of 24.45–30.45.	<u>Plot 8B.1</u> Total foliage cover allocated to Forb Growth (FG) within Plot 8B.1 is 0.4%.	No	Species counted towards FG are comprised of HN526 species only. It is recommended that seeding or planting of additional native forb species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
Ongoing vegetation management	Completion criteria: levels of ecosystem function have been established that demonstrate that the vegetation is self-sustaining or is trending towards self-sustainability. Performance indicators: The cover and species richness of the groundcover is stable or increasing. Evidence of plant reproduction and regeneration is present.	<u>Plot 8B.1</u> Cover and species richness of native groundcover species within the plot is low. No evidence of plant reproduction and regeneration was observed within the plot.	No	Planting of native species has been undertaken within the plot. Future monitoring events will determine if reproduction is viable and will continue without intervention.

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	The cover and species richness of the groundcover, including grasses and forbs, is within the benchmark ranges.	<u>Plot 8B.1</u> Cover and species richness of native groundcover, including grasses and forbs was assessed to be below the benchmark ranges.	No	It is recommended that seeding or planting of native forb species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	Second generation individuals of shrubs and trees are present.	<u>Plot 8B.1</u> No second-generation individuals observed within Plot 8B.1.	No	It is recommended that mechanical slashing is not utilized in these plots to allow opportunity for second generation individuals to continue to establish.
	Cover of 'high threat weeds' (HTW) and 'priority weeds' is no more than 2%.	<u>Plot 8B.1</u> Cover of HTW and priority weeds within the plot was assessed to be 0.3% coverage.	Yes	It is recommended that weed management measures are continued to keep HTW and priority weed species suppressed within Substage 8B.
	Litter cover is within the benchmark range. There is no biometric benchmark, and thus the BAM benchmark of 40 for PCT835 is adopted.	<u>Plot 8B.1</u> Average litter cover was calculated from each five-set sub-plot assessed within Plot 8B.1. Average litter cover: 28%	No	Litter cover is trending towards the BAM benchmark of 40. It is recommended that fallen timber is left in-situ to allow for further increase of litter cover.

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
Substage 8C vegetation management				
Vegetation management, including planting/seeding of native species in Substage 8C area.	Native plant species are characteristic of HN526 as described in the Final Determination as demonstrated by the presence of a suitable number or proportion of ≥24 of the species listed in BRMP Table 5.1.	<u>Plot 8C.1</u> Based on the floristic monitoring records (Appendix A), there are currently 10 species characteristic of HN526 within this plot area.	No	This monitoring period constitutes the first monitoring event for these plots, therefore no prior years monitoring results are available to assess whether HN526 native plant species diversity within monitored plots is trending towards HN526. Tube stock planting was undertaken in this plot area. It is recommended that further planting of additional native species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	The vegetation structure is recognisable as, or is trending towards, the target Biometric Vegetation Type (BVT) HN526, which provides a suitable surrogate for River-flat Eucalypt Forest EEC.	<u>Plot 8C.1</u> Plot 8C.1 was observed to have recently been established, with a soil-stabilising hydromulch applied and rehabilitation plantings having taken place. Three HN526 canopy species were observed within the plot (<i>Angophora floribunda</i>), however these species were observed as seedlings within the groundcover layer. No HN526 midstory species were observed within the plot. Seven HN526 groundcover species were observed within the plot. Total coverage of HN526 groundcover species within the plot is calculated at 10.5%.	No	Tube stock planting was undertaken in this plot area, however further planting is required to increase the diversity and cover of diagnostic species. It is recommended that further seeding or planting of additional native species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	Total foliage cover of species allocated to Tree (TG) growth form is trending towards the benchmark range of 27.5–32.5.	<u>Plot 8C.1</u> Total foliage cover allocated to Tree Growth (TG) within plot 8C.1 is 10%. Three TG species were observed within the rehabilitation plot; however, all were identified to be planted seedlings and not applicable to the Tree layer at time of survey.	No	Species counted towards TG are comprised of HN526 species only. It is recommended that seeding or planting of additional native canopy species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	Total foliage cover of species allocated to Shrub (SG) growth form is trending towards the benchmark range of 21–31.	<u>Plot 8C.1</u> Total foliage cover allocated to Shrub Growth (SG) within plot 8C.1 is 0%.	No	Species counted towards SG are comprised of HN526 species only. It is recommended that seeding or planting of additional native shrub layer species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	Total foliage cover of species allocated to Grass and Grasslike (GG) growth form is trending towards the benchmark range of 24.45–30.45.	<u>Plot 8C.1</u> Total foliage cover allocated to Grass and Grasslike Growth (GG) within plot 8C.1 is 10.1%.	No	Species counted towards GG are comprised of HN526 species only. <i>Cynodon dactylon</i> (Common couch) accounts for 10% of the GG cover and should be supplemented with other native groundcovers to assist with successful rehabilitation. It is recommended that seeding or planting of additional native grass and grasslike species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	Total foliage cover of species allocated to Forb (FG) growth form is trending towards the benchmark range of 24.45–30.45.	<u>Plot 8C.1</u> Total foliage cover allocated to Forb Growth (FG) within plot 8C.1 is 0.4%.	No	Species counted towards FG are comprised of HN526 species only. It is recommended that seeding or planting of additional native forb species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
Ongoing vegetation management	Completion criteria: levels of ecosystem function have been established that demonstrate that the vegetation is self-sustaining or is trending towards self-sustainability. Performance indicators: The cover and species richness of the groundcover is stable or increasing. Evidence of plant reproduction and regeneration is present.	<u>Plot 8C.1</u> Cover and species richness of native groundcover species within the plot is low. No evidence of plant reproduction and regeneration was observed within the plot.	No	Planting of native species has been undertaken within the plot. Future monitoring events will determine if reproduction is viable and will continue without intervention.

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	The cover and species richness of the groundcover, including grasses and forbs, is within the benchmark ranges.	<u>Plot 8C.1</u> Cover and species richness of native groundcover, including grasses and forbs was assessed to be below the benchmark ranges.	No	It is recommended that planting of native forb species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	Second generation individuals of shrubs and trees are present.	<u>Plot 8C.1</u> No second-generation individuals observed within Plot 8C.1.	No	It is recommended that mechanical slashing is not utilized in these plots to allow opportunity for second generation individuals to continue to establish.
	Cover of 'high threat weeds' (HTW) and 'priority weeds' is no more than 2%.	<u>Plot 8C.1</u> Cover of HTW and priority weeds within the plot was assessed to be 2.4% coverage.	No	It is recommended that weed management measures are continued to reduce HTW and priority weed species presence within Substage 8C.
	Litter cover is within the benchmark range. There is no biometric benchmark, and thus the BAM benchmark of 40 for PCT835 is adopted.	<u>Plot 8C.1</u> Average litter cover was calculated from each five-set sub-plot assessed within Plot 8C.1. Average litter cover: 58%	Yes	This monitoring period constitutes the first monitoring event for the Substage 8C plots. Litter cover is above the BAM benchmark of 40, however mulch accounts for much of this value and is likely to decrease in cover in consequent monitoring events. It is recommended that fallen timber is left in-situ to sustain litter cover.

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
Restoration Area 1 vegetation management				
Vegetation management, including planting/seeding of native species in Restoration Area 1.	Native plant species are characteristic of HN526 as described in the Final Determination as demonstrated by the presence of a suitable number or proportion of ≥24 of the species listed in BRMP Table 5.1.	<p><u>Plot 8R1.1</u> Based on the floristic monitoring records (Appendix A), there are currently eight species characteristic of HN526 within this plot area. This has increased by four species since the previous monitoring year. This increase is likely due to incursion of native species adjacent to the plot.</p> <p><u>Plot 8R1.2</u> Based on the floristic monitoring records (Appendix A), there are currently seven species characteristic of HN526 within this plot area. This has increased by two species since the previous monitoring year. This increase is likely due to incursion of native species adjacent to the plot.</p> <p><u>Plot 8R1.3</u> Based on the floristic monitoring records (Appendix A), there are currently seven species characteristic of HN526 within this plot area. This has increased by four species since the previous monitoring year. This increase is likely due to incursion of native species adjacent to the plot.</p>	No	<p>Species characteristic of HN526 have increased in diversity since the previous monitoring year, however additional monitoring is required to determine if the plots are trending towards HN526.</p> <p>It is recommended that further seeding or planting of additional native species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.</p>
	The vegetation structure is recognisable as, or is trending towards, the target Biometric Vegetation Type (BVT) HN526, which provides a suitable surrogate for River-flat Eucalypt Forest EEC.	<p><u>Plot 8R1.1</u> Plot 8R1.1 was observed to have been historically established and additional rehabilitation plantings have not taken place.</p> <p>No HN526 canopy species were observed at the canopy layer within the plot. Two HN526 canopy species were observed within the plot, however these species were observed as seedlings within the groundcover layer, with a coverage of 2%.</p> <p>One HN526 midstory species was observed at the midstory layer (<i>Acacia parramattensis</i>) to comprise 3%</p>	No	<p>Species characteristic of HN526 have increased in cover since the previous monitoring year, however additional monitoring is required to determine if the plots are trending towards HN526.</p> <p>It is recommended that seeding or planting of native species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.</p>

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
		<p>of the plot. Total coverage of HN526 midstory species within the plot is calculated at 3%.</p> <p>Five HN526 groundcover species were observed within the plot. Total coverage of HN526 groundcover species within the plot is calculated at 87.2%.</p> <p><u>Plot 8R1.2</u></p> <p>Plot 8R1.2 was observed to have been historically established and additional rehabilitation plantings have not taken place.</p> <p>No HN526 canopy species were observed at the canopy layer within the plot. Two HN526 canopy species were observed within the plot, however these species were observed as juveniles within the shrub layer, with a coverage of 11%.</p> <p>Two HN526 midstory species were observed within the plot. Total coverage of HN526 midstory species within the plot is calculated at 0.2%.</p> <p>Three HN526 groundcover species were observed within the plot. Total coverage of HN526 groundcover species within the plot is calculated at 40%.</p> <p><u>Plot 8R1.3</u></p> <p>Plot 8R1.3 was observed to have been historically established and additional rehabilitation plantings have not taken place.</p> <p>No HN526 canopy species were observed at the canopy layer within the plot. Four HN526 canopy species were observed within the plot, however these species were observed as seedlings within the groundcover layer, with a coverage of 3.2%.</p> <p>Two HN526 midstory species were observed within the plot. Total coverage of HN526 midstory species within the plot is calculated at 1.1%.</p>		

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
		Two HN526 groundcover species were observed within the plot. Total coverage of HN526 groundcover species within the plot is calculated at 30.1%.		
	Total foliage cover of species allocated to Tree (TG) growth form is trending towards the benchmark range of 27.5–32.5.	<p><u>Plot 8R1.1</u></p> <p>Total foliage cover allocated to Tree Growth (TG) within plot 8R1.1 is 2%.</p> <p><u>Plot 8R1.2</u></p> <p>Total foliage cover allocated to Tree Growth (TG) within plot 8R1.2 is 11%.</p> <p><u>Plot 8R1.3</u></p> <p>Total foliage cover allocated to Tree Growth (TG) within plot 8R1.3 is 3.2%.</p>	No	<p>Species counted towards TG are comprised of HN526 species only.</p> <p>It is recommended that seeding or planting of additional native canopy species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.</p>
	Total foliage cover of species allocated to Shrub (SG) growth form is trending towards the benchmark range of 21–31.	<p><u>Plot 8R1.1</u></p> <p>Total foliage cover allocated to Shrub Growth (SG) within plot 8R1.1 is 3%.</p> <p><u>Plot 8R1.2</u></p> <p>Total foliage cover allocated to Shrub Growth (SG) within plot 8R1.2 is 0.2%.</p> <p><u>Plot 8R1.3</u></p> <p>Total foliage cover allocated to Shrub Growth (SG) within plot 8R1.3 is 1.1%.</p>	No	<p>Species counted towards SG are comprised of HN526 species only.</p> <p>It is recommended that seeding or planting of additional native shrub layer species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.</p>
	Total foliage cover of species allocated to Grass and Grasslike (GG) growth form is trending towards the benchmark range of 24.45–30.45.	<p><u>Plot 8R1.1</u></p> <p>Total foliage cover allocated to Grass and Grasslike Growth (GG) within plot 8R1.1 is 85%.</p> <p><u>Plot 8R1.2</u></p> <p>Total foliage cover allocated to Grass and Grasslike Growth (GG) within plot 8R1.2 is 35%.</p> <p><u>Plot 8R1.3</u></p> <p>Total foliage cover allocated to Grass and Grasslike Growth (GG) within plot 8R1.3 is 30%.</p>	No	<p>Species counted towards GG are comprised of HN526 species only. The plots contain a high cover of one species <i>Cynodon dactylon</i> (Common couch), which should be supplemented with other native groundcovers to assist with successful rehabilitation.</p> <p>It is recommended that seeding or planting of additional native grass and grasslike species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.</p>

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	Total foliage cover of species allocated to Forb (FG) growth form is trending towards the benchmark range of 24.45–30.45.	<p><u>Plot 8R1.1</u></p> <p>Total foliage cover allocated to Forb Growth (FG) within plot 8R1.1 is 2.2%.</p> <p><u>Plot 8R1.2</u></p> <p>Total foliage cover allocated to Forb Growth (FG) within plot 8R1.2 is 5%.</p> <p><u>Plot 8R1.3</u></p> <p>Total foliage cover allocated to Forb Growth (FG) within plot 8R1.3 is 0.1%.</p>	No	<p>Species counted towards FG are comprised of HNS26 species only.</p> <p>It is recommended that planting of additional native forb species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.</p>
Ongoing vegetation management	<p>Completion criteria: levels of ecosystem function have been established that demonstrate that the vegetation is self-sustaining or is trending towards self-sustainability.</p> <p>Performance indicators:</p> <p>The cover and species richness of the groundcover is stable or increasing.</p> <p>Evidence of plant reproduction and regeneration is present.</p>	<p><u>Plot 8R1.1</u></p> <p>Species richness of native groundcover species within the plot is low.</p> <p>No evidence of reproduction or regeneration was observed within Plot 8R1.1.</p> <p><u>Plot 8R1.2</u></p> <p>Species richness of native groundcover species within the plot is low.</p> <p>No evidence of reproduction or regeneration was observed within Plot 8R1.2.</p> <p><u>Plot 8R1.3</u></p> <p>Species richness of native groundcover species within the plot is low.</p> <p>No evidence of reproduction or regeneration was observed within Plot 8R1.3.</p>	No	<p>Historical planting of native species has been undertaken within the plot.</p> <p>Future monitoring events will determine if reproduction and regeneration is viable and will occur without further intervention.</p>

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	The cover and species richness of the groundcover, including grasses and forbs, is within the benchmark ranges.	<p><u>Plot 8R1.1</u></p> <p>Cover and species richness of native groundcover, including grasses and forbs was assessed to be outside the benchmark ranges.</p> <p><u>Plot 8R1.2</u></p> <p>Cover and species richness of native groundcover, including grasses and forbs was assessed to be outside the benchmark ranges.</p> <p><u>Plot 8R1.3</u></p> <p>Species richness of native groundcover, including grasses and forbs was assessed to be outside the benchmark ranges.</p> <p>Species cover of native groundcover was assessed to be within the benchmark ranges.</p>	No	It is recommended that seeding or planting of native forb species is undertaken in accordance with the species list outlined in Table 5.1 of the BRMP.
	Second generation individuals of shrubs and trees are present.	<p><u>Plot 8R1.1</u></p> <p>No second-generation individuals observed within Plot 8R1.1.</p> <p><u>Plot 8R1.2</u></p> <p>No second-generation individuals observed within Plot 8R1.2.</p> <p><u>Plot 8R1.3</u></p> <p>No second-generation individuals observed within Plot 8R1.3.</p>	No	It is recommended that mechanical slashing is not utilized in these plots to allow opportunity for second generation individuals to continue to establish.

Management actions	Performance/ completion criteria	Monitoring results and trends	Management action completed? (Yes/No)	Effectiveness of management actions, progressive improvements, and other comments
	Cover of 'high threat weeds' (HTW) and 'priority weeds' is no more than 2%.	<p><u>Plot 8R1.1</u></p> <p>Cover of HTW and priority weeds within the plot was assessed to be 4.2%.</p> <p><u>Plot 8R1.2</u></p> <p>Cover of HTW and priority weeds within the plot was assessed to be 15.1%.</p> <p><u>Plot 8R1.3</u></p> <p>Cover of HTW and priority weeds within the plot was assessed to be 16.3%.</p>	No	It is recommended that weed management measures are continued to reduce HTW and priority weed species presence within Substage 8C.
	Litter cover is within the benchmark range. There is no biometric benchmark, and thus the BAM benchmark of 40 for PCT835 is adopted.	<p>Average litter cover was calculated from each 5-set sub-plot per plot.</p> <p><u>Plot 8R1.1</u></p> <p>Average litter cover: 93%</p> <p><u>Plot 8R1.2</u></p> <p>Average litter cover: 23%</p> <p><u>Plot 8R1.3</u></p> <p>Average litter cover: 7.4%</p>	No	Litter cover is above the BAM benchmark of 40 for Plot 8R1.1, however recent slashing accounts for much of this value and is likely to decrease in cover in consequent monitoring events. It is recommended that fallen timber is left in-situ to sustain litter cover.



Source: Menangle and Soil.

Figure 3.1 Restoration Area 1 Clump Long Stem Planting



Source: Menangle and Soil.

Figure 3.2 Substage 8A Clump Long Stem Planting



Source: Menangle and Soil.

Figure 3.3 Substage 8B Clump Long Stem Planting



Source: Menangle and Soil.

Figure 3.4 Substage 8C Clump Long Stem Planting

3.1.2 Photo-point monitoring

Photo-point monitoring results are presented below. These will be used in future monitoring programs to provide a visual reference of restoration/rehabilitation success.

Photo-point monitoring		
2024 (05/03/24)		2025 (13/03/25)
Site	6.1	
Photo-point no.	1	
<p>Comments about how to take the photo consistently each time, improvements, problems, etc.:</p> <p>Photo was taken with camera resting upon top of star picket with plot label corflute sign attached. Photo taken at 45-degree angle across site from star picket.</p>		
		

Photo-point monitoring		
2024 (05/03/24)		2025 (13/03/25)
Site	6.2	
Photo-point no.	1	
Comments about how to take the photo consistently each time, improvements, problems, etc.:		
Photo was taken with camera resting upon top of star picket with plot label corflute sign attached. Photo taken at 45-degree angle across site from star picket.		


Photo-point monitoring		
2024 (05/03/24)		2025 (13/03/25)
Site	7.1	
Photo-point no.	1	
Comments about how to take the photo consistently each time, improvements, problems, etc.:		
Photo was taken with camera resting upon top of star picket with plot label corflute sign attached. Photo taken at 45-degree angle across site from star picket.		
		



Photo-point monitoring		
2024 (05/03/24))		2025 (13/03/25)
Site	7.3	
Photo-point no.	1	
Comments about how to take the photo consistently each time, improvements, problems, etc.:		
Photo was taken with camera resting upon top of star picket with plot label corflute sign attached. Photo taken perpendicular to star picket across site. Photo points were not consistent between 2024 and 2025 due to observer error.		
		

Photo-point monitoring		
2024 (05/03/24)		2025 (13/03/25)
Site	7.5	
Photo-point no.	1	
Comments about how to take the photo consistently each time, improvements, problems, etc.:		
Photo was taken with camera resting upon top of star picket with plot label corflute sign attached. Photo taken at 45-degree angle across site from star picket. Photo monitoring point is inconsistent between years due to observer error.		
		

Photo-point monitoring

2024 (05/03/24)

2025 (14/03/25)

Site 8R1.1

Photo-point no. 1

Comments about how to take the photo consistently each time, improvements, problems, etc.:

Photo was taken with camera resting upon top of star picket with plot label corflute sign attached. Photo taken at 45-degree angle across site from star picket.



Photo-point monitoring

2024 (05/03/24)

2025 (14/03/25)

Site 8R1.2

Photo-point no. 1

Comments about how to take the photo consistently each time, improvements, problems, etc.:

Photo was taken with camera resting upon top of star picket with plot label corflute sign attached. Photo taken at 45-degree angle across site from star picket.



Photo-point monitoring

2024 (05/03/24)

2025 (14/03/25)

Site 8R1.3

Photo-point no. 1

Comments about how to take the photo consistently each time, improvements, problems, etc.:

Photo was taken with camera resting upon top of star picket with plot label corflute sign attached. Photo taken at 45-degree angle across site from star picket.



Photo-point monitoring

2024 (05/03/24)

2025 (14/03/25)

Site 8A.1

Photo-point no. 1

Comments about how to take the photo consistently each time, improvements, problems, etc.:

Photo was taken with camera resting upon top of star picket with plot label corflute sign attached. Photo taken at 45-degree angle across site from star picket.




Photo-point monitoring		
2024		2025 (14/03/25)
Site	8B.1	<div>2025 is the first year of monitoring.</div> 
Photo-point no.	1	
Comments about how to take the photo consistently each time, improvements, problems, etc.:		
Photo was taken with camera resting upon top of star picket with plot label corflute sign attached. Photo taken at 45-degree angle across site from star picket.		

Photo-point monitoring		
2024		2025 (14/03/25)
Site	8C.1	<div>2025 is the first year of monitoring.</div> 
Photo-point no.	1	
Comments about how to take the photo consistently each time, improvements, problems, etc.:		
Photo was taken with camera resting upon top of star picket with plot label corflute sign attached. Photo taken at 45-degree angle across site from star picket.		

3.2 Weed monitoring

3.2.1 Weed monitoring records

Weeds monitoring results within the plots are provided in Appendix A.

Weed monitoring and mapping was also undertaken in restoration management areas within the quarry site, targeting the presence and coverage of Lantana, Privet, and novel weed species as described in Section 2.2.

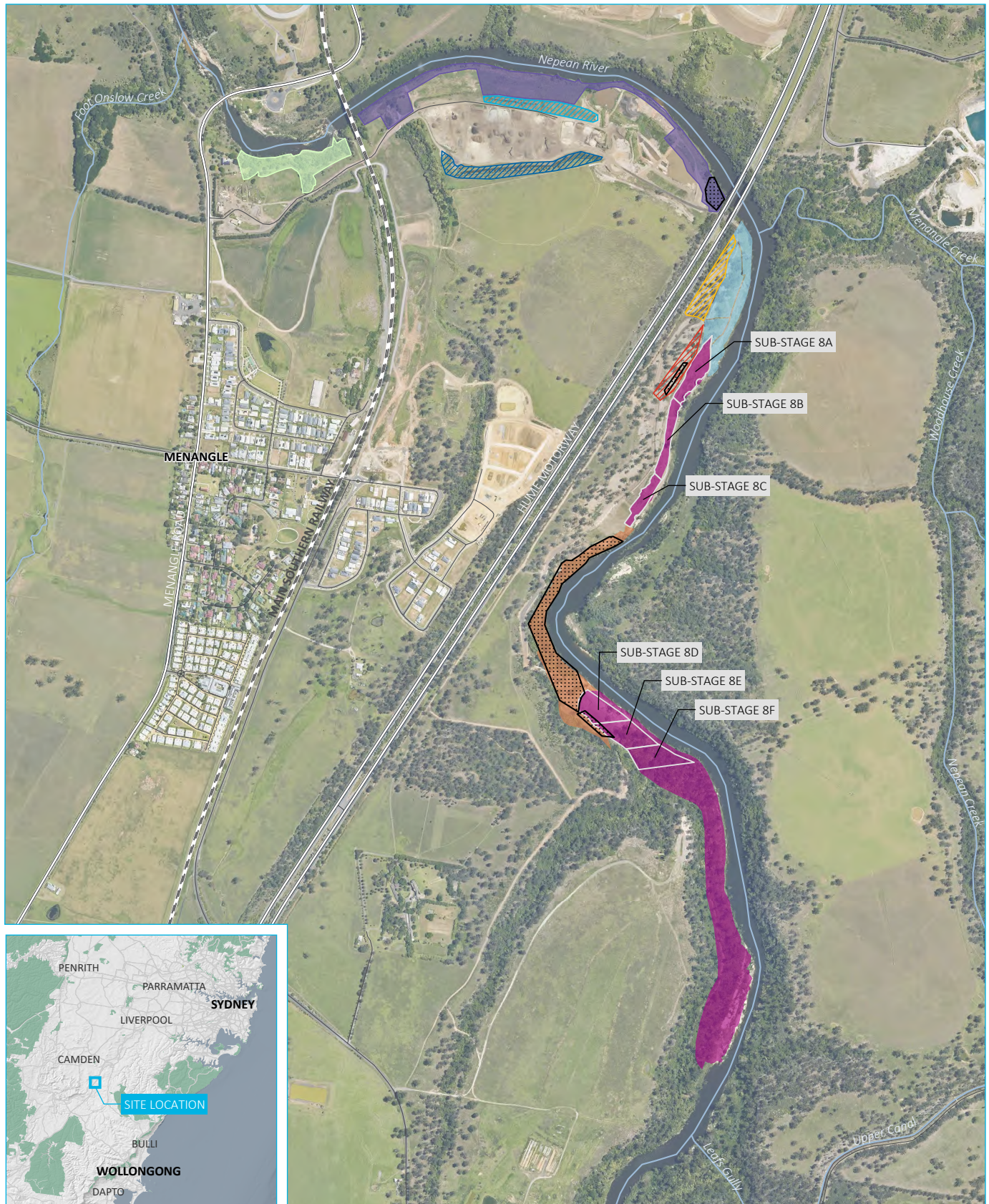
The weed monitoring results are presented in Table 3.2 and mapped in Figure 3.5 and Figure 3.6. Areas not surveyed are not included in the figures provided. Two species previously recorded in project vegetation surveys, Balloon Vine (*Cardiospermum grandiflorum*) and Trad (*Tradescantia fluminensis*) were observed to have established dense infestations in select areas of the site. As these species have been previously recorded in project vegetation surveys they do not qualify as novel weed species under the BRMP. Nonetheless, management of these species is recommended (Section 3.2.4).

Table 3.2 Weed monitoring records

Date	Area (e.g. Substage 8A)	Surveyed area (ha)	Lantana			Privet			Novel weed species			
			Cover (ha)	Cover (%) ¹	Locations >25 m ² , see map below Patches 1–25 m ² , see map below or provide coordinates	Cover (ha)	Cover (%) ¹	Locations >25 m ² , see map below Patches 1–25 m ² , see map below or provide coordinates	Species	Cover (ha)	Cover (%) ¹	Locations >25 m ² , see map below Patches 1–25 m ² , see map below or provide coordinates
6/3/2024	Stage 6	2.00	0	0	N/A	0	0	N/A	N/A	N/A	N/A	N/A
6/3/2024	Stage 7	7.41	0.36	80	See maps below	0.41	80	See maps below	N/A	N/A	N/A	N/A
6/3/2024	Additional Restoration Area 2	6.51	0.21	40	See maps below	0.10	100	See maps below	N/A	N/A	N/A	N/A
13/3/2025	Stage 6	0.82	0	0	See maps below	0	0	See maps below	N/A	N/A	N/A	N/A
13/3/2025	Stage 7	3.18	0.33	80	See maps below	0.46	16	See maps below	N/A	N/A	N/A	N/A
13/3/2025	Restoration Area 1	2.83	0	0	N/A	0	0	N/A	N/A	N/A	N/A	N/A
13/3/2025	Stage 8A	0.80	0	0	N/A	0	0	N/A	N/A	N/A	N/A	N/A
13/3/2025	Stage 8B	0.79	0	0	N/A	0	0	N/A	N/A	N/A	N/A	N/A
13/3/2025	Stage 8C	0.45	0	0	N/A	0	0	N/A	N/A	N/A	N/A	N/A
13/3/2025	Stage 8D ²	0.37	0.18	60	See maps below	N/A	N/A	N/A	N/A	N/A	N/A	N/A
13/3/2025	Stage 8F ²	0.68	N/A	N/A	N/A	0.55	25	See maps below	N/A	N/A	N/A	N/A
13/3/2025	Stage 8 - Additional Restoration Area 1	1.1	0	0	N/A	0	0	N/A	N/A	N/A	N/A	N/A
13/3/2025	Stage 8 - Additional Restoration Area 2	2.42	0.11	20	See maps below	N/A	N/A	N/A	N/A	N/A	N/A	N/A
13/3/2025	Restoration Area 2 ²	3	2.87	20	See maps below	2.77	20	See maps below	N/A	N/A	N/A	N/A

Notes: 1. Represents visually estimated percent foliage cover within the mapped weed area.

2. Weed management has not commenced and is not included in analysis.



Source: EMM (2025); ABS (2021); DCSSS (2024); GA (2009); MetroMap (2025)

KEY
 Lantana (*Lantana camara*) (>25 m²)

Vegetation management area
 Stage 6
 Stage 7

Existing environment
 Rail line
 Major road
 Minor road
 Named watercourse

Restoration area
 Stage 1
 Stage 2
 Stage 3 - extraction/rehabilitation area
 Substage boundary

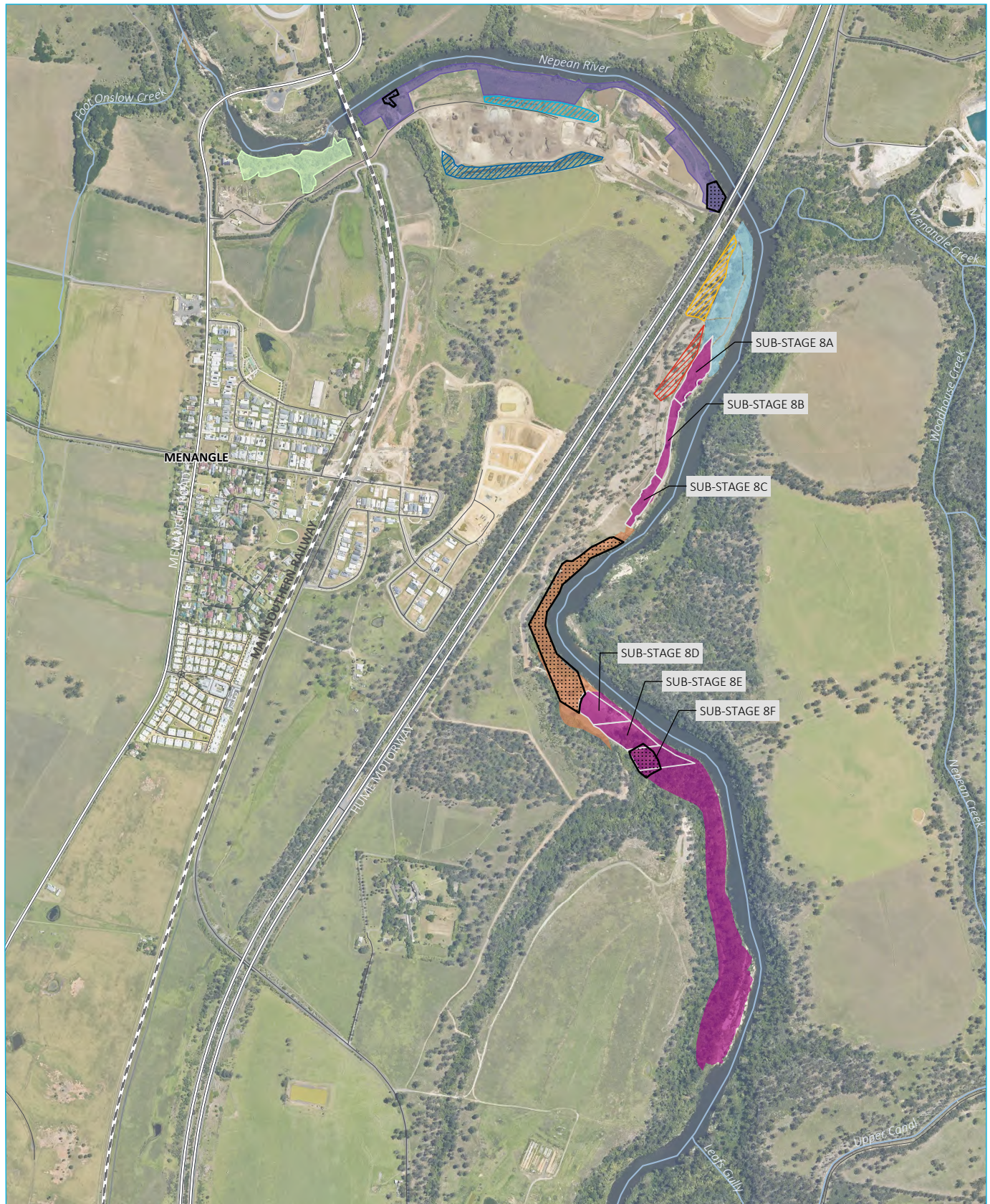
Additional restoration area
 Stage 7 area 1
 Stage 7 area 2
 Stage 8 area 1
 Stage 8 area 2

INSET KEY

Major road
 NPWS reserve
 State forest

Mapped locations of Lantana
 (13 March 2025)

Menangle Sand and Soil Quarry
 Weed Mapping
 Figure 3.5



Source: EMM (2025); DCSSS (2024); GA (2009); MetroMap (2025)

KEY

Privet (*Ligustrum sinense* and *Ligustrum lucidum*) (>25 m²)

Vegetation management area

Stage 6

Stage 7

Existing environment

Rail line

Major road

Minor road

Named watercourse

Restoration area

Stage 1

Stage 2

Stage 8 - extraction/rehabilitation area

Substage boundary

Additional restoration area

Stage 7 area 1

Stage 7 area 2

Stage 8 area 1

Stage 8 area 2

0 250 500
m
GDA 1994 MGA Zone 56
N

Mapped locations of Privet
(13 March 2025)

Menangle Sand and Soil Quarry
Weed Mapping
Figure 3.6

3.2.2 Progress against performance and completion criteria

Weed management completion criteria, performance indicators, performance guidance and corrective actions are provided in BRMP Table 8.2. Progress against weed performance and completion criteria is summarised in Table 3.3.

Table 3.3 Weed management summary

Weed	Coverage last year (ha)	Coverage this year (ha)	% change	Requirement met? (Yes/No)
Lantana (<i>Lantana camara</i>)	0.58	0.44	-25	No
Small-leaved Privet (<i>Ligustrum sinense</i>)	0.41	0.46	+12	No
Broad-leaf Privet (<i>Ligustrum lucidum</i>)				

Notes: Management of Restoration Area 2 has not commenced and is not included in these results.

3.2.3 Annual trends

The weed monitoring shows marginal change in lantana and privet coverage since 2024 (Figure 3.5 and Figure 3.6).

3.2.4 Effectiveness of weed management measures

In general, the rehabilitation and restoration areas of the site are heavily impacted by ongoing weed invasion or recruitment. As identified in Section 1, flooding has occurred throughout all Stages and has deposited soil throughout. As such, the availability of weed propagules has increased significantly has reduced efficacy of management measures. Whilst two species previously recorded in project vegetation surveys (Balloon Vine and Trad) were observed to have established dense infestations in select areas of the site, these species do not qualify as novel weed species as were also observed during the BRMP surveys. However, due to the invasiveness of both species and observed prevalence on site they have therefore been identified as additional priority weed species to be managed as part of weed control efforts.

References

EMM. (2022). *Biodiversity and Rehabilitation Management Plan*.

EMM. (2023). *Ecological Pre-clearance Assessment - Menangle Quarry Sub-stages 8a and 8b*.

Urban Agronomy & Soil Science (UASS). (2024). *Stage 8 Extraction Area – Changes to the Rehabilitation Methodology*, Prepared for Menangle Sand and Soil.

Appendix A

Floristic monitoring datasheets

BAM Site – Field Survey Form

Plot ID:	6.1	Date:	13/03/2025	Project number:	190166a	Plot dimensions:	20x20	
Datum:	GDA94	Easting:	291,653	Recorders:	Other, Luke Haeusler, William Vile			
Zone:	56	Northing:	6,222,281	IBRA region:		Midline bearing:	310	
Plant Community Type:	835: Cumberland riverflat forest				Condition class:	Poor	PCT % cleared:	93.00%
Vegetation Formation:	Forested Wetlands				Veg. Class:	Coastal Floodplain Wetlands		

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	2
	Shrubs:	1
	Grasses etc.:	1
	Forbs:	1
	Ferns:	0
	Other:	0
Sum of Cover of native vascular plants by growth form group	Trees:	3
	Shrubs:	0.1
	Grasses etc.:	1
	Forbs:	0.1
	Ferns:	0
Other:	0	
High Threat Weed cover:		6.4

BAM Attribute (1000 m2 plot) DBH			
DBH	Tree stem count	Length of logs (m) (≥10 cm diameter, >50 cm in length)	0
80 + cm:	0		
50 – 79 cm:	1		
30 – 49 cm:	1		
20 – 29 cm:	1	Tree hollow count	0
10 – 19 cm:	1		
5 – 9 cm:	1		
< 5 cm:	1		

Counts apply when no. of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For multi-stemmed tree, only largest living stem is included in the count. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)				
Subplot:	1	2	3	4	5
Subplot score (%):	90	90	80	95	95
Average litter cover (%):	90				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography and site features	
Soil colour:	Landform element: Flat
Soil texture:	Landform pattern:

Plot Disturbance
No regen of overstory sp evident. <5cm class consisted of small planted trees. No habitat logs but fallen branches creating some woody habitat. Plot has been mulched and that makes up ~50% of leaf litter cover.

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code (if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
 Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
 Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Project name:	190166a				
Recorders:	Other,Luke Haeusler, William Vile	Plot ID:	6.1	Date:	13/03/2025

GF Code	Scientific name	Cover	Abundance	Voucher	N, E or HTE
	<i>Modiola caroliniana</i> (Red-flowered Mallow)	0.1	1		E
	<i>Trifolium repens</i> (White Clover)	0.1	1		E
	<i>Euphorbia peplus</i> (Petty Spurge)	0.1	1		E
	<i>Alternanthera philoxeroides</i> (Alligator Weed)	0.1	1		HTE
	<i>Sonchus oleraceus</i> (Common Sowthistle)	0.1	1		E
Grass & grasslike (GG)	<i>Cynodon dactylon</i> (Common Couch)	1	1		N
	<i>Cardiospermum grandiflorum</i> (Balloon Vine)	0.1	1		HTE
	<i>Tradescantia fluminensis</i> (Wandering Jew)	0.1	1		HTE
	<i>Echinochloa crus-galli</i> (Barnyard Grass)	5	1		E
	<i>Sida rhombifolia</i> (Paddy's Lucerne)	0.1	1		E
	<i>Bromus catharticus</i> (Praire Grass)	0.1	1		E
	<i>Verbena bonariensis</i> (Purpletop)	0.1	1		E
Forb (FG)	<i>Einadia trigonos</i> (Fishweed)	0.1	1		N
	<i>Solanum nigrum</i> (Black-berry Nightshade)	0.1	1		E
	<i>Bidens subalternans</i> (Greater Beggar's Ticks)	1	1		HTE
	<i>Bidens pilosa</i> (Cobbler's Pegs)	0.1	1		HTE
	<i>Solanum mauritianum</i> (Wild Tobacco Bush)	0.1	1		E
	<i>Stellaria media</i> (Common Chickweed)	0.1	1		E
	<i>Galium aparine</i> (Goosegrass)	0.1	1		E
Shrub (SG)	<i>Acacia</i> spp. (Wattle)	0.1	1		N
	<i>Fumaria</i> spp. (Fumitory)	1	1		E
	<i>Solanum sisymbriifolium</i>	1	1		E
	<i>Cenchrus clandestinus</i> (Kikuyu Grass)	5	1		HTE
	<i>Eucalyptus saligna</i> x <i>botryoides</i>	25	1		
Tree (TG)	<i>Angophora floribunda</i> (Rough-barked Apple)	1	1		N
Tree (TG)	<i>Eucalyptus amplifolia</i> (Cabbage Gum)	2	1		N

BAM Site – Field Survey Form

Plot ID:	6.2	Date:	13/03/2025	Project number:	190166a	Plot dimensions:	20x20	
Datum:	GDA94	Easting:	291,820	Recorders:	Luke Haeusler,Other, William Vile			
Zone:	56	Northing:	6,222,315	IBRA region:		Midline bearing:	267	
Plant Community Type:	835: Cumberland riverflat forest				Condition class:	Poor	PCT % cleared:	93.00%
Vegetation Formation:	Forested Wetlands				Veg. Class:	Coastal Floodplain Wetlands		

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	3
	Shrubs:	0
	Grasses etc.:	3
	Forbs:	1
	Ferns:	0
	Other:	0
Sum of Cover of native vascular plants by growth form group	Trees:	37
	Shrubs:	0
	Grasses etc.:	1.2
	Forbs:	0.1
	Ferns:	0
	Other:	0
High Threat Weed cover:		1.4

BAM Attribute (1000 m2 plot) DBH			
DBH	Tree stem count	Length of logs (m) (≥10 cm diameter, >50 cm in length)	3
80 + cm:	0		
50 – 79 cm:	0		
30 – 49 cm:	1		
20 – 29 cm:	1	Tree hollow count	0
10 – 19 cm:	1		
5 – 9 cm:	1		
< 5 cm:	1		

Counts apply when no. of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For multi-stemmed tree, only largest living stem is included in the count. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)				
Subplot:	1	2	3	4	5
Subplot score (%):	65	70	80	90	90
Average litter cover (%):	79				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography and site features	
Soil colour:	Landform element: Flat
Soil texture:	Landform pattern: Floodplains

Plot Disturbance
Maybe One example of overstory regen. Leaf litter consists of mulching and stems leftover from weed control and casuarina needles. Some woody habitat from fallen branches 3m of habitat size log. No evidence of recent flooding

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code (if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
 Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
 Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Project name:	190166a				
Recorders:	Luke Haeusler,Other, William Vile	Plot ID:	6.2	Date:	13/03/2025

GF Code	Scientific name	Cover	Abundance	Voucher	N, E or HTE
	<i>Lysimachia arvensis</i> (Scarlet Pimpernel)	0.1	1		E
Tree (TG)	<i>Acacia parramattensis</i> (Parramatta Wattle)	15	1		N
Tree (TG)	<i>Casuarina cunninghamiana</i> subsp. <i>cunninghamiana</i> (River Oak)	20	1		N
	<i>Eucalyptus saligna</i> x <i>botryoides</i>	3	1		
Tree (TG)	<i>Eucalyptus amplifolia</i> (Cabbage Gum)	2	1		N
	<i>Euphorbia peplus</i> (Petty Spurge)	0.5	1		E
	<i>Tradescantia fluminensis</i> (Wandering Jew)	1	1		HTE
	<i>Dactylis glomerata</i> (Cocksfoot)	0.1	1		E
	<i>Conyza</i> spp. (A Fleabane)	0.1	1		E
	<i>Sida rhombifolia</i> (Paddy's Lucerne)	0.1	1		E
Grass & grasslike (GG)	<i>Lomandra longifolia</i> (Spiny-headed Mat-rush)	0.1	1		N
Grass & grasslike (GG)	<i>Themeda triandra</i>	0.1	1		N
	<i>Araujia sericifera</i> (Moth Vine)	0.1	1		HTE
	<i>Brassica</i> spp. (Brassica)	0.1	1		E
	<i>Plantago lanceolata</i> (Lamb's Tongues)	0.1	1		E
	<i>Chenopodium ambrosioides</i> (Mexican Tea)	0.1	1		E
	<i>Digitaria sanguinalis</i> (Crab Grass)	2	1		E
	<i>Cardiospermum grandiflorum</i> (Balloon Vine)	0.1	1		HTE
	<i>Conium maculatum</i> (Hemlock)	5	1		E
	<i>Chenopodium album</i> (Fat Hen)	0.1	1		E
	<i>Sonchus oleraceus</i> (Common Sowthistle)	1	1		E
	<i>Sonchus asper</i> (Prickly Sowthistle)	0.1	1		E
	<i>Galium aparine</i> (Goosegrass)	0.1	1		E
	<i>Echinochloa crus-galli</i> (Barnyard Grass)	2	1		E
	<i>Conyza bonariensis</i> (Flaxleaf Fleabane)	1	1		E
Grass & grasslike (GG)	<i>Cynodon dactylon</i> (Common Couch)	1	1		N
	<i>Alternanthera philoxeroides</i> (Alligator Weed)	0.1	1		HTE
	<i>Bidens subalternans</i> (Greater Beggar's Ticks)	0.1	1		HTE
	<i>Fumaria</i> spp. (Fumitory)	0.1	1		E
Forb (FG)	<i>Youngia</i> spp.	0.1	1		N
	<i>Cirsium vulgare</i> (Spear Thistle)	0.1	1		E
	<i>Aster subulatus</i> (Wild Aster)	0.1	1		E

BAM Site – Field Survey Form

Plot ID:	7.1	Date:	13/03/2025	Project number:	E190166a	Plot dimensions:	20x20	
Datum:	GDA94	Easting:	292,069	Recorders:	Luke Haeusler,Other, William Vile			
Zone:	56	Northing:	6,222,512	IBRA region:		Midline bearing:	315	
Plant Community Type:	835: Cumberland riverflat forest				Condition class:	Poor	PCT % cleared:	93.00%
Vegetation Formation:	Forested Wetlands				Veg. Class:	Coastal Floodplain Wetlands		

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	4
	Shrubs:	2
	Grasses etc.:	1
	Forbs:	2
	Ferns:	0
	Other:	0
Sum of Cover of native vascular plants by growth form group	Trees:	35.2
	Shrubs:	0.2
	Grasses etc.:	1
	Forbs:	1.1
	Ferns:	0
	Other:	0
High Threat Weed cover:		11.4

BAM Attribute (1000 m2 plot) DBH			
DBH	Tree stem count	Length of logs (m) (≥10 cm diameter, >50 cm in length)	2
80 + cm:	0		
50 – 79 cm:	0		
30 – 49 cm:	0		
20 – 29 cm:	0	Tree hollow count	0
10 – 19 cm:	1		
5 – 9 cm:	1		
< 5 cm:	1		

Counts apply when no. of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For multi-stemmed tree, only largest living stem is included in the count. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)				
Subplot:	1	2	3	4	5
Subplot score (%):	80	10	50	60	60
Average litter cover (%):	52				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography and site features	
Soil colour:	Landform element: Flat
Soil texture:	Landform pattern: Floodplains

Plot Disturbance
Some stick habitat beneath acacia, evidence of flooding, casuarina needles around bases of plants. Mulch remains in half the plot. Acacia parramattensis regeneration present.

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code (if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
 Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
 Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Project name:	E190166a				
Recorders:	Luke Haeusler,Other, William Vile	Plot ID:	7.1	Date:	13/03/2025

GF Code	Scientific name	Cover	Abundance	Voucher	N, E or HTE
Tree (TG)	<i>Casuarina cunninghamiana</i> subsp. <i>cunninghamiana</i> (River Oak)	15	1		N
Tree (TG)	<i>Acacia parramattensis</i> (Parramatta Wattle)	20	1		N
Shrub (SG)	<i>Leptospermum polygalifolium</i> (Tantoon)	0.1	1		N
Tree (TG)	<i>Eucalyptus elata</i> (River Peppermint)	0.1	1		N
Tree (TG)	<i>Eucalyptus amplifolia</i> (Cabbage Gum)	0.1	1		N
Forb (FG)	<i>Euphorbia</i> spp.	1	1		N
	<i>Brassica</i> spp. (Brassica)	2	1		E
	<i>Sonchus asper</i> (Prickly Sowthistle)	1	1		E
	<i>Sonchus oleraceus</i> (Common Sowthistle)	1	1		E
	<i>Senecio madagascariensis</i> (Fireweed)	0.1	1		HTE
	<i>Solanum sisymbriifolium</i>	1	1		E
	<i>Digitaria sanguinalis</i> (Crab Grass)	0.1	1		E
	<i>Eleusine indica</i> (Crowsfoot Grass)	0.1	1		E
	<i>Sida rhombifolia</i> (Paddy's Lucerne)	0.1	1		E
Shrub (SG)	<i>Acacia</i> spp. (Wattle)	0.1	1		N
Grass & grasslike (GG)	<i>Cynodon dactylon</i> (Common Couch)	1	1		N
	<i>Conyza bonariensis</i> (Flaxleaf Fleabane)	1	1		E
	<i>Ricinus communis</i> (Castor Oil Plant)	2	1		HTE
	<i>Cenchrus clandestinus</i> (Kikuyu Grass)	5	1		HTE
	<i>Bidens pilosa</i> (Cobbler's Pegs)	0.1	1		HTE
	<i>Tradescantia fluminensis</i> (Wandering Jew)	1	1		HTE
Forb (FG)	<i>Sigesbeckia orientalis</i> subsp. <i>orientalis</i> (Indian Weed)	0.1	1		N
	<i>Araujia sericifera</i> (Moth Vine)	1	1		HTE
	<i>Ligustrum sinense</i> (Small-leaved Privet)	1	1		HTE
	<i>Ligustrum lucidum</i> (Large-leaved Privet)	0.1	1		HTE
	<i>Ehrharta erecta</i> (Panic Veldtgrass)	1	1		HTE
	<i>Cardiospermum grandiflorum</i> (Balloon Vine)	0.1	1		HTE

BAM Site – Field Survey Form

Plot ID:	7.3	Date:	13/03/2025	Project number:	E190166a			Plot dimensions:	20x20
Datum:	GDA94	Easting:	292,387	Recorders:	Luke Haeusler,Other, William Vile				
Zone:	56	Northing:	6,222,541	IBRA region:				Midline bearing:	301
Plant Community Type:			835: Cumberland riverflat forest			Condition class:	Poor	PCT % cleared:	93.00%
Vegetation Formation:			Forested Wetlands			Veg. Class:	Coastal Floodplain Wetlands		

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	2
	Shrubs:	1
	Grasses etc.:	3
	Forbs:	1
	Ferns:	0
	Other:	0
Sum of Cover of native vascular plants by growth form group	Trees:	21
	Shrubs:	2
	Grasses etc.:	86.1
	Forbs:	0.1
	Ferns:	0
	Other:	0
High Threat Weed cover:		16.2

BAM Attribute (1000 m2 plot) DBH			
DBH	Tree stem count	Length of logs (m) (≥10 cm diameter, >50 cm in length)	7
80 + cm:	0		
50 – 79 cm:	0		
30 – 49 cm:	0		
20 – 29 cm:	0	Tree hollow count	0
10 – 19 cm:	0		
5 – 9 cm:	0		
< 5 cm:	1		

Counts apply when no. of tree stems within a size class is ≤ 10 . Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For multi-stemmed trees, only largest living stem is included in the count. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)				
Subplot:	1	2	3	4	5
Subplot score (%):	5	0	0	5	1
Average litter cover (%):	2.2				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography and site features			
Soil colour:		Landform element:	Flat
Soil texture:		Landform pattern:	Floodplains

Plot Disturbance
7m of log habitat no other wooded habitat. Regen of euc. Species occurring widely. Couch dominated understory, little to no leaf litter. No mulch present.

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code (if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
 Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
 Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Project name:	E190166a				
Recorders:	Luke Haeusler,Other, William Vile	Plot ID:	7.3	Date:	13/03/2025

GF Code	Scientific name	Cover	Abundance	Voucher	N, E or HTE
Grass & grasslike (GG)	<i>Cynodon dactylon</i> (Common Couch)	85	1		N
Tree (TG)	<i>Eucalyptus amplifolia</i> (Cabbage Gum)	20	1		N
Grass & grasslike (GG)	<i>Lomandra longifolia</i> (Spiny-headed Mat-rush)	1	1		N
	<i>Megathyrsus maximus</i>	1	1		HTE
	<i>Sida rhombifolia</i> (Paddy's Lucerne)	1	1		E
Shrub (SG)	<i>Acacia floribunda</i> (White Sally)	2	1		N
Tree (TG)	<i>Acacia parramattensis</i> (Parramatta Wattle)	1	1		N
	<i>Paspalum quadrifarium</i> (Tussock Paspalum)	15	1		HTE
	<i>Verbena bonariensis</i> (Purpletop)	1	1		E
	<i>Solanum sisymbriifolium</i>	0.1	1		E
Grass & grasslike (GG)	<i>Setaria</i> spp.	0.1	1		N
	<i>Bidens pilosa</i> (Cobbler's Pegs)	0.1	1		HTE
	<i>Tagetes minuta</i> (Stinking Roger)	1	1		E
Forb (FG)	<i>Plantago</i> spp. (Plantain)	0.1	1		N
	<i>Ligustrum sinense</i> (Small-leaved Privet)	0.1	1		HTE

BAM Site – Field Survey Form

Plot ID:	7.5	Date:	13/03/2025	Project number:	E190166a	Plot dimensions:	20x20	
Datum:	GDA94	Easting:	292,931	Recorders:	Luke Haeusler, Other, William Vile			
Zone:	56	Northing:	6,222,278	IBRA region:		Midline bearing:	17	
Plant Community Type:	835: Cumberland riverflat forest				Condition class:	Poor	PCT % cleared:	93.00%
Vegetation Formation:	Forested Wetlands				Veg. Class:	Coastal Floodplain Wetlands		

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	2
	Shrubs:	2
	Grasses etc.:	1
	Forbs:	0
	Ferns:	0
	Other:	0
Sum of Cover of native vascular plants by growth form group	Trees:	0.2
	Shrubs:	1.1
	Grasses etc.:	80
	Forbs:	0
	Ferns:	0
	Other:	0
High Threat Weed cover:		3

BAM Attribute (1000 m2 plot) DBH			
DBH	Tree stem count	Length of logs (m) (≥10 cm diameter, >50 cm in length)	
80 + cm:	0		0
50 – 79 cm:	0		
30 – 49 cm:	0		
20 – 29 cm:	0		
10 – 19 cm:	0	Tree hollow count	0
5 – 9 cm:	0		
< 5 cm:	0		

Counts apply when no. of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For multi-stemmed tree, only largest living stem is included in the count. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)				
Subplot:	1	2	3	4	5
Subplot score (%):	95	70	50	75	0
Average litter cover (%):	58				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography and site features	
Soil colour:	
Soil texture:	
	Landform element: Flat
	Landform pattern: Floodplains

Plot Disturbance
High weed cover. Has been mulched. No wooded habitat. No trees. No regen.

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code (if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
 Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
 Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Project name:	E190166a				
Recorders:	Luke Haeusler,Other, William Vile	Plot ID:	7.5	Date:	13/03/2025

GF Code	Scientific name	Cover	Abundance	Voucher	N, E or HTE
	<i>Tagetes minuta</i> (Stinking Roger)	40	1		E
Grass & grasslike (GG)	<i>Cynodon dactylon</i> (Common Couch)	80	1		N
	<i>Conyza bonariensis</i> (Flaxleaf Fleabane)	8	1		E
	<i>Ricinus communis</i> (Castor Oil Plant)	1	1		HTE
	<i>Sonchus asper</i> (Prickly Sowthistle)	2	1		E
	<i>Digitaria sanguinalis</i> (Crab Grass)	0.5	1		E
	<i>Brassica</i> spp. (Brassica)	1	1		E
	<i>Verbena bonariensis</i> (Purpletop)	1	1		E
Tree (TG)	<i>Eucalyptus amplifolia</i> (Cabbage Gum)	0.1	1		N
Tree (TG)	<i>Eucalyptus elata</i> (River Peppermint)	0.1	1		N
	<i>Araujia sericifera</i> (Moth Vine)	1	1		HTE
	<i>Echinochloa crus-galli</i> (Barnyard Grass)	1	1		E
Shrub (SG)	<i>Trema tomentosa</i> var. <i>aspera</i> (Native Peach)	1	1		N
Shrub (SG)	<i>Acacia floribunda</i> (White Sally)	0.1	1		N
	<i>Bidens pilosa</i> (Cobbler's Pegs)	1	1		HTE

BAM Site – Field Survey Form

Plot ID:	8A.1	Date:	14/03/2025	Project number:	J190166a			
Datum:	GDA94	Easting:	292,918	Recorders:	Luke Haeusler, Other, William Vile	Plot dimensions:	20x20	
Zone:	56	Northing:	6,221,675	IBRA region:		Midline bearing:	63	
Plant Community Type:	835: Cumberland riverflat forest				Condition class:	Poor	PCT % cleared:	93.00%
Vegetation Formation:	Forested Wetlands				Veg. Class:	Coastal Floodplain Wetlands		

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	2
	Shrubs:	7
	Grasses etc.:	4
	Forbs:	5
	Ferns:	0
	Other:	0
Sum of Cover of native vascular plants by growth form group	Trees:	0.2
	Shrubs:	0.7
	Grasses etc.:	22.2
	Forbs:	0.5
	Other:	0
High Threat Weed cover:		8.5

BAM Attribute (1000 m2 plot) DBH			
DBH	Tree stem count	Length of logs (m) (≥10 cm diameter, >50 cm in length)	0
80 + cm:	2		
50 – 79 cm:	0		
30 – 49 cm:	0		
20 – 29 cm:	0	Tree hollow count	2
10 – 19 cm:	0		
5 – 9 cm:	0		
< 5 cm:	1		

Counts apply when no. of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For multi-stemmed tree, only largest living stem is included in the count. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)				
Subplot:	1	2	3	4	5
Subplot score (%):	20	5	5	25	10
Average litter cover (%):	13				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography and site features	
Soil colour:	
Landform element:	Flat
Soil texture:	
Landform pattern:	Floodplains
On a sand flat 15m out from the river bank	

Plot Disturbance
Sandy and not mowed recently. Hakea, eucalyptus and acacia regen. Woody habitat in trees(hollows). No ground woody habitat, very open and exposed.

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code (if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
 Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
 Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Project name:	J190166a				
Recorders:	Luke Haeusler,Other, William Vile	Plot ID:	8A.1	Date:	14/03/2025

GF Code	Scientific name	Cover	Abundance	Voucher	N, E or HTE
	<i>Eucalyptus saligna</i> x <i>botryoides</i>	10	1		
Tree (TG)	<i>Angophora floribunda</i> (Rough-barked Apple)	0.1	1		N
Shrub (SG)	<i>Acacia floribunda</i> (White Sally)	0.1	1		N
Shrub (SG)	<i>Acacia longifolia</i>	0.1	1		N
Tree (TG)	<i>Acacia parramattensis</i> (Parramatta Wattle)	0.1	1		N
Forb (FG)	<i>Einadia trigonos</i> (Fishweed)	0.1	1		N
	<i>Phytolacca octandra</i> (Inkweed)	0.1	1		E
Grass & grasslike (GG)	<i>Cynodon dactylon</i> (Common Couch)	20	1		N
Grass & grasslike (GG)	<i>Setaria</i> spp.	2	1		N
	<i>Digitaria sanguinalis</i> (Crab Grass)	0.1	1		E
	<i>Cyperus eragrostis</i> (Umbrella Sedge)	0.1	1		HTE
	<i>Sida rhombifolia</i> (Paddy's Lucerne)	0.1	1		E
	<i>Solanum sisymbriifolium</i>	0.1	1		E
	<i>Solanum nigrum</i> (Black-berry Nightshade)	0.1	1		E
	<i>Cenchrus clandestinus</i> (Kikuyu Grass)	5	1		HTE
	<i>Amaranthus viridis</i> (Green Amaranth)	0.1	1		E
Shrub (SG)	<i>Callicoma</i> sp. 'Whian Whian'	0.1	1		N
	<i>Cardiospermum grandiflorum</i> (Balloon Vine)	0.1	1		HTE
	<i>Paspalum dilatatum</i> (Paspalum)	0.1	1		HTE
	<i>Conyza bonariensis</i> (Flaxleaf Fleabane)	1	1		E
Forb (FG)	<i>Plantago</i> spp. (Plantain)	0.1	1		N
Forb (FG)	<i>Dichondra repens</i> (Kidney Weed)	0.1	1		N
	<i>Tradescantia fluminensis</i> (Wandering Jew)	1	1		HTE
	<i>Ehrharta erecta</i> (Panic Veldtgrass)	2	1		HTE
Grass & grasslike (GG)	<i>Juncus usitatus</i>	0.1	1		N
Shrub (SG)	<i>Phyllanthus gunnii</i>	0.1	1		N
Shrub (SG)	<i>Trema tomentosa</i> var. <i>aspera</i> (Native Peach)	0.1	1		N
Forb (FG)	<i>Commelina cyanea</i> (Native Wandering Jew)	0.1	1		N
	<i>Ligustrum lucidum</i> (Large-leaved Privet)	0.1	1		HTE
Shrub (SG)	<i>Hakea</i> spp.	0.1	1		N
	<i>Paspalum quadrifarium</i> (Tussock Paspalum)	0.1	1		HTE
Grass & grasslike (GG)	<i>Austrostipa</i> spp. (A Speargrass)	0.1	1		N
	<i>Cirsium vulgare</i> (Spear Thistle)	0.1	1		E
	<i>Verbena bonariensis</i> (Purpletop)	0.1	1		E
Forb (FG)	<i>Sigesbeckia orientalis</i> subsp. <i>orientalis</i> (Indian Weed)	0.1	1		N
Shrub (SG)	<i>Callistemon</i> spp.	0.1	1		N

BAM Site – Field Survey Form

Plot ID:	88.1	Date:	14/03/2025	Project number:	J190166a			
Datum:	GDA94	Easting:	292,865	Recorders:	Luke Haeusler, Other, William Vile	Plot dimensions:	20x20	
Zone:	56	Northing:	6,221,591	IBRA region:		Midline bearing:	52	
Plant Community Type:	835: Cumberland riverflat forest				Condition class:	Poor	PCT % cleared:	93.00%
Vegetation Formation:	Forested Wetlands				Veg. Class:	Coastal Floodplain Wetlands		

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	3
	Shrubs:	1
	Grasses etc.:	5
	Forbs:	4
	Ferns:	0
	Other:	0
Sum of Cover of native vascular plants by growth form group	Trees:	0.3
	Shrubs:	0.1
	Grasses etc.:	15.4
	Forbs:	0.4
	Other:	0
High Threat Weed cover:		1.2

BAM Attribute (1000 m2 plot) DBH			
DBH	Tree stem count	Length of logs (m) (≥10 cm diameter, >50 cm in length)	10
80 + cm:	0		
50 – 79 cm:	0		
30 – 49 cm:	0		
20 – 29 cm:	0	Tree hollow count	0
10 – 19 cm:	0		
5 – 9 cm:	0		
< 5 cm:	1		

Counts apply when no. of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For multi-stemmed tree, only largest living stem is included in the count. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)				
Subplot:	1	2	3	4	5
Subplot score (%):	30	10	55	5	40
Average litter cover (%):	28				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography and site features	
Soil colour:	
Landform element:	Flat
Soil texture:	Landform pattern: Floodplains

Plot Disturbance
No overstory regen. Not mowed. First time surveyed. One large fallen tree of woody habitat only. Some mulch present

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code (if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
 Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
 Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Project name:	J190166a				
Recorders:	Luke Haeusler, Other, William Vile	Plot ID:	8B.1	Date:	14/03/2025

GF Code	Scientific name	Cover	Abundance	Voucher	N, E or HTE
	<i>Echinochloa crus-galli</i> (Barnyard Grass)	1	1		E
	<i>Eleusine indica</i> (Crowsfoot Grass)	4	1		E
Tree (TG)	<i>Angophora floribunda</i> (Rough-barked Apple)	0.1	1		N
	<i>Digitaria sanguinalis</i> (Crab Grass)	25	1		E
Grass & grasslike (GG)	<i>Cynodon dactylon</i> (Common Couch)	15	1		N
	<i>Ehrharta erecta</i> (Panic Veldtgrass)	1	1		HTE
Tree (TG)	<i>Eucalyptus elata</i> (River Peppermint)	0.1	1		N
Grass & grasslike (GG)	<i>Cyperus</i> spp.	0.1	1		N
	<i>Senecio madagascariensis</i> (Fireweed)	0.1	1		HTE
	<i>Conyza bonariensis</i> (Flaxleaf Fleabane)	0.1	1		E
	<i>Trifolium repens</i> (White Clover)	0.1	1		E
Forb (FG)	<i>Einadia trigonos</i> (Fishweed)	0.1	1		N
Forb (FG)	<i>Wahlenbergia</i> spp. (Bluebell)	0.1	1		N
Grass & grasslike (GG)	<i>Eragrostis</i> spp. (A Lovegrass)	0.1	1		N
	<i>Hypochaeris radicata</i> (Catsear)	0.1	1		E
	<i>Solanum nigrum</i> (Black-berry Nightshade)	0.1	1		E
	<i>Verbena litoralis</i>	0.1	1		E
	<i>Lolium</i> spp. (A Ryegrass)	0.1	1		E
	<i>Eucalyptus saligna</i> x <i>botryoides</i>	15	1		
Tree (TG)	<i>Casuarina cunninghamiana</i> subsp. <i>cunninghamiana</i> (River Oak)	0.1	1		N
Shrub (SG)	<i>Acacia floribunda</i> (White Sally)	0.1	1		N
Forb (FG)	<i>Dichondra repens</i> (Kidney Weed)	0.1	1		N
	<i>Modiola caroliniana</i> (Red-flowered Mallow)	0.1	1		E
	<i>Bidens pilosa</i> (Cobbler's Pegs)	0.1	1		HTE
	<i>Solanum sisymbriifolium</i>	0.1	1		E
Forb (FG)	<i>Sigesbeckia orientalis</i> subsp. <i>orientalis</i> (Indian Weed)	0.1	1		N
	<i>Sonchus oleraceus</i> (Common Sowthistle)	0.1	1		E
Grass & grasslike (GG)	<i>Juncus usitatus</i>	0.1	1		N
Grass & grasslike (GG)	<i>Setaria</i> spp.	0.1	1		N
	<i>Galinsoga parviflora</i> (Potato Weed)	0.1	1		E
	<i>Tagetes minuta</i> (Stinking Roger)	0.1	1		E

BAM Site – Field Survey Form

Plot ID:	8C.1	Date:	14/03/2025	Project number:	J190166a	Plot dimensions:	20x20	
Datum:	GDA94	Easting:	292,788	Recorders:	Luke Haeusler,Other, William Vile			
Zone:	56	Northing:	6,221,381	IBRA region:		Midline bearing:	92	
Plant Community Type:	835: Cumberland riverflat forest				Condition class:	Poor	PCT % cleared:	93.00%
Vegetation Formation:	Forested Wetlands				Veg. Class:	Coastal Floodplain Wetlands		

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	3
	Shrubs:	0
	Grasses etc.:	4
	Forbs:	7
	Ferns:	0
	Other:	0
Sum of Cover of native vascular plants by growth form group	Trees:	0.3
	Shrubs:	0
	Grasses etc.:	12.2
	Forbs:	0.7
	Ferns:	0
Other:	0	
High Threat Weed cover:		0.3

BAM Attribute (1000 m2 plot) DBH			
DBH	Tree stem count	Length of logs (m) (≥10 cm diameter, >50 cm in length)	30
80 + cm:	0		
50 – 79 cm:	0		
30 – 49 cm:	0		
20 – 29 cm:	0	Tree hollow count	0
10 – 19 cm:	0		
5 – 9 cm:	0		
< 5 cm:	1		

Counts apply when no. of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For multi-stemmed tree, only largest living stem is included in the count. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)				
Subplot:	1	2	3	4	5
Subplot score (%):	100	95	10	5	80
Average litter cover (%):	58				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography and site features	
Soil colour:	Landform element: Flat
Soil texture:	Landform pattern: Floodplains

Plot Disturbance
Mulching evident. Not mowed. Large fallen trees providing woody habitat. No overstory regen.

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code (if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
 Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
 Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Project name:	J190166a				
Recorders:	Luke Haeusler,Other, William Vile	Plot ID:	8C.1	Date:	14/03/2025

GF Code	Scientific name	Cover	Abundance	Voucher	N, E or HTE
	<i>Echinochloa crus-galli</i> (Barnyard Grass)	3	1		E
	<i>Digitaria sanguinalis</i> (Crab Grass)	5	1		E
	<i>Eleusine indica</i> (Crowsfoot Grass)	2	1		E
Grass & grasslike (GG)	<i>Setaria</i> spp.	2	1		N
	<i>Verbena bonariensis</i> (Purpletop)	2	1		E
	<i>Tagetes minuta</i> (Stinking Roger)	0.1	1		E
	<i>Verbena litoralis</i>	1	1		E
	<i>Conyza bonariensis</i> (Flaxleaf Fleabane)	2	1		E
	<i>Acetosa sagittata</i> (Rambling Dock)	0.1	1		HTE
	<i>Bidens pilosa</i> (Cobbler's Pegs)	0.1	1		HTE
Grass & grasslike (GG)	<i>Cyperus</i> spp.	0.1	1		N
	<i>Cyperus</i> spp.2	0.1	1		
	<i>Eleusine tristachya</i> (Goose Grass)	0.1	1		E
Forb (FG)	<i>Persicaria decipiens</i> (Slender Knotweed)	0.1	1		N
	<i>Euphorbia peplus</i> (Petty Spurge)	0.1	1		E
Forb (FG)	<i>Youngia</i> spp.	0.1	1		N
	<i>Sonchus asper</i> (Prickly Sowthistle)	0.1	1		E
	<i>Sonchus oleraceus</i> (Common Sowthistle)	0.1	1		E
Forb (FG)	<i>Wahlenbergia</i> spp. (Bluebell)	0.1	1		N
Grass & grasslike (GG)	<i>Panicum</i> spp. (Panicum)	0.1	1		N
Tree (TG)	<i>Angophora floribunda</i> (Rough-barked Apple)	0.1	1		N
	<i>Eucalyptus saligna</i> x <i>botryoides</i>	1	1		
Tree (TG)	<i>Eucalyptus elata</i> (River Peppermint)	0.1	1		N
	<i>Modiola caroliniana</i> (Red-flowered Mallow)	2	1		E
	<i>Verbascum</i> spp.	0.1	1		E
	<i>Hypochaeris radicata</i> (Catsear)	0.1	1		E
Forb (FG)	<i>Plantago</i> spp. (Plantain)	0.1	1		N
	<i>Senecio madagascariensis</i> (Fireweed)	0.1	1		HTE
Forb (FG)	<i>Portulaca oleracea</i> (Pigweed)	0.1	1		N
Forb (FG)	<i>Einadia trigonos</i> (Fishweed)	0.1	1		N
Forb (FG)	<i>Sigesbeckia orientalis</i> subsp. <i>orientalis</i> (Indian Weed)	0.1	1		N
	<i>Solanum nigrum</i> (Black-berry Nightshade)	0.1	1		E
	<i>Phytolacca octandra</i> (Inkweed)	0.1	1		E
	<i>Brassica</i> spp. (Brassica)	0.1	1		E
	<i>Solanum sisymbriifolium</i>	0.1	1		E
	<i>Trifolium repens</i> (White Clover)	0.1	1		E
	<i>Anagallis</i> spp.	0.1	1		E
Grass & grasslike (GG)	<i>Cynodon dactylon</i> (Common Couch)	10	1		N
	<i>Hirschfeldia incana</i> (Buchan Weed)	0.1	1		E
Tree (TG)	<i>Casuarina cunninghamiana</i> subsp. <i>cunninghamiana</i> (River Oak)	0.1	1		N

BAM Site – Field Survey Form

Plot ID:	8R1.1	Date:	14/03/2025	Project number:	J190166a			
Datum:	GDA94	Easting:	293,035	Recorders:	Luke Haeusler, Other, William Vile	Plot dimensions:	20x20	
Zone:	56	Northing:	6,222,040	IBRA region:		Midline bearing:	60	
Plant Community Type:	835: Cumberland riverflat forest				Condition class:	Poor	PCT % cleared:	93.00%
Vegetation Formation:	Forested Wetlands				Veg. Class:	Coastal Floodplain Wetlands		

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	2
	Shrubs:	0
	Grasses etc.:	2
	Forbs:	4
	Ferns:	0
	Other:	0
Sum of Cover of native vascular plants by growth form group	Trees:	4
	Shrubs:	0
	Grasses etc.:	89
	Forbs:	2.2
	Ferns:	0
High Threat Weed cover:		4

BAM Attribute (1000 m2 plot) DBH			
DBH	Tree stem count	Length of logs (m) (≥10 cm diameter, >50 cm in length)	1
80 + cm:	0		
50 – 79 cm:	0		
30 – 49 cm:	0		
20 – 29 cm:	0	Tree hollow count	0
10 – 19 cm:	0		
5 – 9 cm:	0		
< 5 cm:	1		

Counts apply when no. of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For multi-stemmed tree, only largest living stem is included in the count. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)				
Subplot:	1	2	3	4	5
Subplot score (%):	95	90	95	95	90
Average litter cover (%):	93				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography and site features	
Soil colour:	Landform element: Lower slope
Soil texture:	Landform pattern: Floodplains

Plot Disturbance
Heavily mowed. No regen of overstory. Couch dominated understory. Two fallen branches in plot but very limited woody habitat. High leaf litter as it has been recently brushcut

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code (if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
 Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
 Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Project name:	J190166a				
Recorders:	Luke Haeusler,Other, William Vile	Plot ID:	8R1.1	Date:	14/03/2025

GF Code	Scientific name	Cover	Abundance	Voucher	N, E or HTE
Grass & grasslike (GG)	<i>Cynodon dactylon</i> (Common Couch)	85	1		N
	<i>Paspalum dilatatum</i> (Paspalum)	4	1		HTE
Grass & grasslike (GG)	<i>Setaria</i> spp.	4	1		N
Tree (TG)	<i>Acacia parramattensis</i> (Parramatta Wattle)	3	1		N
	<i>Eucalyptus saligna</i> x <i>botryoides</i>	1	1		
Tree (TG)	<i>Angophora floribunda</i> (Rough-barked Apple)	1	1		N
	<i>Cirsium vulgare</i> (Spear Thistle)	0.1	1		E
Forb (FG)	<i>Einadia trigonos</i> (Fishweed)	1	1		N
	<i>Conyza bonariensis</i> (Flaxleaf Fleabane)	0.1	1		E
Forb (FG)	<i>Persicaria decipiens</i> (Slender Knotweed)	1	1		N
	<i>Sonchus oleraceus</i> (Common Sowthistle)	0.1	1		E
	<i>Tagetes minuta</i> (Stinking Roger)	0.1	1		E
Forb (FG)	<i>Dichondra repens</i> (Kidney Weed)	0.1	1		N
Forb (FG)	<i>Oxalis perennans</i>	0.1	1		N
	<i>Sida rhombifolia</i> (Paddy's Lucerne)	0.1	1		E

BAM Site – Field Survey Form

Plot ID:	8R1.2	Date:	14/03/2025	Project number:	J190166a	Plot dimensions:	20x20	
Datum:	GDA94	Easting:	292,969	Recorders:	Luke Haeusler,Other, William Vile			
Zone:	56	Northing:	6,221,869	IBRA region:		Midline bearing:	45	
Plant Community Type:	835: Cumberland riverflat forest				Condition class:	Poor	PCT % cleared:	93.00%
Vegetation Formation:	Forested Wetlands				Veg. Class:	Coastal Floodplain Wetlands		

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	1
	Shrubs:	3
	Grasses etc.:	2
	Forbs:	2
	Ferns:	0
	Other:	1
Sum of Cover of native vascular plants by growth form group	Trees:	1
	Shrubs:	0.3
	Grasses etc.:	43
	Forbs:	5
	Ferns:	0
Other:	0.1	
High Threat Weed cover:		11.1

BAM Attribute (1000 m2 plot) DBH			
DBH	Tree stem count	Length of logs (m) (≥10 cm diameter, >50 cm in length)	0
80 + cm:	0		
50 – 79 cm:	0		
30 – 49 cm:	0		
20 – 29 cm:	0	Tree hollow count	0
10 – 19 cm:	0		
5 – 9 cm:	1		
< 5 cm:	1		

Counts apply when no. of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For multi-stemmed tree, only largest living stem is included in the count. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)				
Subplot:	1	2	3	4	5
Subplot score (%):	20	10	80	0	5
Average litter cover (%):	23				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography and site features			
Soil colour:		Landform element:	Lower slope
Soil texture:	Sand	Landform pattern:	Floodplains

Plot Disturbance
Half of the plot is recently mowed. No wooded habitat. No overstory regen pressnt

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code (if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
 Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
 Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Project name:	J190166a				
Recorders:	Luke Haeusler,Other, William Vile		Plot ID:	8R1.2	Date: 14/03/2025

GF Code	Scientific name	Cover	Abundance	Voucher	N, E or HTE
Shrub (SG)	<i>Phyllanthus gunnii</i>	0.1	1		N
	<i>Acetosa sagittata</i> (Rambling Dock)	1	1		HTE
	<i>Bidens pilosa</i> (Cobbler's Pegs)	2	1		HTE
Shrub (SG)	<i>Sambucus australasica</i> (Native Elderberry)	0.1	1		N
Other (OG)	<i>Kennedia rubicunda</i> (Dusky Coral Pea)	0.1	1		N
Forb (FG)	<i>Sigesbeckia orientalis</i> subsp. <i>orientalis</i> (Indian Weed)	1	1		N
Grass & grasslike (GG)	<i>Cynodon dactylon</i> (Common Couch)	35	1		N
Grass & grasslike (GG)	<i>Setaria</i> spp.	8	1		N
	<i>Senecio madagascariensis</i> (Fireweed)	0.1	1		HTE
	<i>Conyza bonariensis</i> (Flaxleaf Fleabane)	4	1		E
	<i>Verbena bonariensis</i> (Purpletop)	1	1		E
	<i>Phytolacca octandra</i> (Inkweed)	0.1	1		E
	<i>Cenchrus clandestinus</i> (Kikuyu Grass)	8	1		HTE
Tree (TG)	<i>Eucalyptus amplifolia</i> (Cabbage Gum)	1	1		N
	<i>Eucalyptus saligna</i> x <i>botryoides</i>	10	1		
	<i>Phalaris aquatica</i> (Phalaris)	1	1		E
Forb (FG)	<i>Einadia trigonos</i> (Fishweed)	4	1		N
	<i>Tagetes minuta</i> (Stinking Roger)	1	1		E
Shrub (SG)	<i>Trema tomentosa</i> var. <i>aspera</i> (Native Peach)	0.1	1		N
	<i>Sida rhombifolia</i> (Paddy's Lucerne)	0.1	1		E
	<i>Digitaria sanguinalis</i> (Crab Grass)	0.1	1		E
	<i>Dactylis glomerata</i> (Cocksfoot)	0.1	1		E

BAM Site – Field Survey Form

Plot ID:	8R1.3	Date:	14/03/2025	Project number:	J190166a			
Datum:	GDA94	Easting:	292,951	Recorders:	Luke Haeusler, Other, William Vile	Plot dimensions:	20x20	
Zone:	56	Northing:	6,221,839	IBRA region:		Midline bearing:	141	
Plant Community Type:	835: Cumberland riverflat forest				Condition class:	Poor	PCT % cleared:	93.00%
Vegetation Formation:	Forested Wetlands				Veg. Class:	Coastal Floodplain Wetlands		

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	3
	Shrubs:	3
	Grasses etc.:	2
	Forbs:	2
	Ferns:	0
	Other:	0
Sum of Cover of native vascular plants by growth form group	Trees:	1.2
	Shrubs:	1.2
	Grasses etc.:	70
	Forbs:	0.2
	Other:	0
High Threat Weed cover:		5.2

BAM Attribute (1000 m2 plot) DBH			
DBH	Tree stem count	Length of logs (m) (≥10 cm diameter, >50 cm in length)	
80 + cm:	0		4
50 – 79 cm:	0		
30 – 49 cm:	0		
20 – 29 cm:	0		
10 – 19 cm:	0	Tree hollow count	1
5 – 9 cm:	0		
< 5 cm:	1		

Counts apply when no. of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For multi-stemmed tree, only largest living stem is included in the count. Tree stems must be living.

For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)				
Subplot:	1	2	3	4	5
Subplot score (%):	15	2	5	0	15
Average litter cover (%):	7.4				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography and site features	
Soil colour:	
Landform element:	Lower slope
Soil texture:	Landform pattern: Floodplains

Plot Disturbance
Not mowed. 2 large stag trees, one fallen branch. Good woody habitat provided by stags. No mulching evident. No overstory regen. Plot larger than 20x20, one side is 29m. Trapezium shape.

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code (if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
 Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
 Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Project name:	J190166a				
Recorders:	Luke Haeusler,Other, William Vile	Plot ID:	8R1.3	Date:	14/03/2025

GF Code	Scientific name	Cover	Abundance	Voucher	N, E or HTE
Tree (TG)	<i>Eucalyptus elata</i> (River Peppermint)	0.1	1		N
Tree (TG)	<i>Eucalyptus amplifolia</i> (Cabbage Gum)	1	1		N
	<i>Eucalyptus saligna</i> x <i>botryoides</i>	2	1		
Shrub (SG)	<i>Acacia floribunda</i> (White Sally)	1	1		N
Tree (TG)	<i>Melia azedarach</i> (White Cedar)	0.1	1		N
	<i>Verbena bonariensis</i> (Purpletop)	2	1		E
	<i>Conyza bonariensis</i> (Flaxleaf Fleabane)	10	1		E
	<i>Bidens pilosa</i> (Cobbler's Pegs)	2	1		HTE
Grass & grasslike (GG)	<i>Cynodon dactylon</i> (Common Couch)	30	1		N
	<i>Cenchrus clandestinus</i> (Kikuyu Grass)	3	1		HTE
Grass & grasslike (GG)	<i>Setaria</i> spp.	40	1		N
	<i>Tagetes minuta</i> (Stinking Roger)	4	1		E
	<i>Megathyrus maximus</i>	0.1	1		HTE
	<i>Solanum sisymbriifolium</i>	1	1		E
	<i>Solanum mauritianum</i> (Wild Tobacco Bush)	0.1	1		E
Shrub (SG)	<i>Trema tomentosa</i> var. <i>aspera</i> (Native Peach)	0.1	1		N
	<i>Brassica</i> spp. (Brassica)	0.1	1		E
	<i>Hirschfeldia incana</i> (Buchan Weed)	0.1	1		E
Forb (FG)	<i>Calomeria amaranthoides</i> (Incense Plant)	0.1	1		N
Shrub (SG)	<i>Sambucus australasica</i> (Native Elderberry)	0.1	1		N
Forb (FG)	<i>Sigesbeckia orientalis</i> subsp. <i>orientalis</i> (Indian Weed)	0.1	1		N
	<i>Tradescantia fluminensis</i> (Wandering Jew)	0.1	1		HTE

Australia

SYDNEY

Level 10, 201 Pacific Highway
St Leonards NSW 2065
T 02 9493 9500

NEWCASTLE

Level 3, 175 Scott Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE

Level 1, 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

CANBERRA

Level 2, Suite 2.04
15 London Circuit
Canberra City ACT 2601

ADELAIDE

Level 4, 74 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE

188 Normanby Road
Southbank VIC 3006

PERTH

Level 9, Suite 9.02
109 St Georges Terrace
Perth WA 6831

Canada

TORONTO

2345 Yonge Street, Suite 300
Toronto ON M4P 2E5

VANCOUVER

60 W 6th Ave Suite 200
Vancouver BC V5Y 1K1



[linkedin.com/company/emm-consulting-pty-limited](https://www.linkedin.com/company/emm-consulting-pty-limited)



emmconsulting.com.au

Menangle Sand and Soil Quarry - Rolling Schedule of compliance

Scheduled actions	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Actions during 2024/2025 with varying frequencies thereafter												
Road Safety and Condition Audit							X ^a	X ^a	Due 4 Sept 2024 ^a	X	X	X
Nest-box installation	X	X	X	X	X	X	X	X	By 4 Sept 2024	X	X	X
Independent Environmental Audit									Commission by 4 Sept 2024 ^b	X ^b	Extension End March 2025	X
Dust deposition gauge monitoring review	X	X	X	X	X	Reviewed	X	X	X	X	X	X
Noise compliance assessment preparation (completed 2023)												
Monthly												
Monthly dust deposition gauge monitoring	X	X	X	X	X	X	X	X	X	X	X	X
Record process water use	X	X	X	X	X	X	X	X	X	X	X	X
Monthly complaints register update	X	X	X	X	X	X	X	X	X	X	X	X
Monthly erosion and sediment control measures review	X	X	X	X	X	X	X	X	X	X	X	X
Monthly surface water quality sampling (2024), then quarterly			X	X	X	X	X	X	X	X	X	X
Quarterly												
Quarterly attended noise monitoring			X			X			X			X
Quarterly groundwater logger download and bore inspection	X			X			X			X		
Quarterly EMS review			X			X			X			X
Six-monthly												
Truck records to website		X					X					
Annual Review tasks												
Annual groundwater quality sampling and analysis			X									
Annual water review preparation				X								
Landform establishment and stability assessment report preparation	X	X	X									
Growth medium development assessment report preparation	X	X	X									
Floristic monitoring report preparation		X	X									
Weed monitoring report preparation		X	X									
Nest-box and woody debris report preparation	X	X	X									
Rehabilitation and Restoration Site Annual Progress Report		X	X									
Annual Review preparation	X	X	End March									
Annual Return tasks												
Annual Return preparation						X	Due 9 August					
Other annual tasks												
Annual production data to MEG	Due 30 January 2025	X	Submitted									
Review management plans (if not otherwise triggered)				X	X	Due 31 June ^d	X	Finalised				
Annual EMS internal audit				X	X	X	X	Finalised				
Actions for 2026, and then every three years												
Air quality monitoring program review								4 Sept 2026 ^c				
Noise monitoring program review								4 Sept 2026 ^c				

- a. then every 5 years.
- b. then every 3 years.
- c. not required for compliance.
- d. if not otherwise triggered by a modification, audit or incident

Mandatory date

Date not specified by a condition

Calendar does not include ongoing, triggered or one-off requirements.



URBAN AGRONOMY and
SOIL SCIENCE



Menangle Sand and Soil

Stage 8 Extraction Area
Changes to the Rehabilitation Methodology

Urban Agronomy & Soil Science

Murray Fraser

October 2024

Executive Summary

Urban Agronomy & Soil Science (UASS) were commissioned by Menangle Sand & Soil Pty Ltd (the Company) to develop a revised revegetation strategy for Stage 8 that explores a range of planting techniques aimed at significantly improving the establishment of native species across the site. In response to challenges posed by frequent Nepean River flooding, which has buried previous plantings and facilitated weed re-establishment, the Company's new approach will incorporate multiple methods, including the Long Stem Tube Stock Planting Technique and the use of mature tree plantings.

The Long Stem Tube Stock technique, specifically designed for flood-prone areas, allows for deeper planting and promotes root growth along buried stems, increasing plant resilience against sediment deposition and erosion. Additionally, planting mature trees is expected to contribute immediate structural stability and provide shelter for developing vegetation, fostering quicker ecosystem establishment. Each plot will feature a mix of pioneer, mid-storey, and canopy species to establish a diverse plant community adapted to site conditions. Strategically placed logs in the plot centres will support young plants, help retain soil moisture and create microhabitats for local fauna.

To enhance site stability and manage weeds, the Company will also direct-seed and regularly slash inter-plot areas with native ground cover species. This approach promotes soil stability, reduces weed competition, and keeps access routes open for maintenance. By combining intensive plots with managed inter-plot zones, the strategy aims to create a resilient, connected landscape that will evolve into a self-sustaining riverine ecosystem. Ultimately, the Company envisions transforming its riverfront land into a naturally restored, community-accessible park along the Nepean River, reflecting their commitment to sustainable ecological restoration in a challenging environment.



Figure1: Existing vegetation at Menangle Stage 8 - predominantly exotic weeds with a sparse occurrence of mature native trees.

1. Introduction

Menangle Sand & Soil (the Company) is revising its methodology for revegetating post-extraction areas in Stage 8 of its Menangle extraction operations. This change reflects the challenges and lessons learned from recent years, where revegetation techniques involving a mix of tubestock planting and hydromulching have faced significant setbacks due primarily to issues associated with the regularity and severity of flooding in the rehabilitation zones that has consistently deposited sand and/or silt over the revegetated areas, flooded away the brush stations put in place, burying and killing a substantial number of planted seedlings and tubestock. Additionally, these flooding events have reintroduced weed species, complicating efforts to maintain weed control across the large areas dedicated to native species re-establishment.

To address these challenges, the Company is adopting a new, more flexible approach that combines the benefits of focused planting efforts within plots and practical weed management strategies across broader areas. The goal remains the successful establishment of at least 24 of the 40 indigenous species listed in the Consent document, which aligns with the Company's commitment to ecological restoration and long-term sustainability.

2. New Revegetation Approach: Intensive Planting Plots

The Company will now concentrate revegetation efforts within discrete planting plots, approximately 8 metres by 8 metres (about 64 square metres each). These plots will be strategically distributed across the rehabilitation zones based on site conditions and flood dynamics. Key features of this approach include:

2.1 Central Log Placement:

Where feasible, each plot will feature a large log placed in the centre. The logs will serve multiple ecological functions, including:

- a. Providing shelter for young plants.
- b. Supporting soil moisture retention by diverting water and reducing flow rates around the plots.
- c. Acting as visual markers for plot identification and maintenance.
- d. Creating microhabitats that support local fauna and contribute to overall ecosystem health.

2.2 Species Selection and Plot Groupings:

The Company has categorised the revegetation plots into three groups, identified as Group 1, Group 2, and Group 3.

Each group will consist of a mix of species that include:

- 2.2.1 Colonisers and Pioneers:** Fast-growing species well-suited to disturbed environments that can stabilise soils, reduce erosion, and improve conditions for the establishment of other vegetation.
- 2.2.2 Mid-Storey Species (Small Trees and Shrubs):** These species provide structure to the revegetation areas and contribute to weed suppression and wildlife habitat.
- 2.2.3 Canopy and Long-Term Species:** Slower-growing species that will form the upper layers of the vegetation community, restoring the original plant community composition over time.
- 2.2.4** This approach ensures that each planting plot contains a diverse mix of species serving different ecological roles, rather than each group being dedicated to a specific function.

2.3 Long-stem Tubestock Planting Technique

The Long Stem Tube Stock Planting Technique is a method developed in Australia to improve the success rate of native plant revegetation, especially in challenging environments like riverine and riparian zones. This technique involves cultivating native plants in nurseries to a stage where they develop long stems, typically 50–100 cm in height, before planting. These plants have an extended stem section that can be buried deeper in the soil than traditional tube stock, allowing them to root along the buried stem and better anchor themselves in loose or shifting substrates.

2.3.1 Method Overview

In this technique, seedlings are grown longer than typical tube stock, fostering robust root and stem systems. When planted, the long stem is buried well below the soil surface, often with only the top foliage exposed. This deep planting helps secure the plant in place, protecting it from erosion, grazing pressure, and damage from flooding events. The buried stem also encourages additional root development along its length, which enhances the plant's stability and resilience.

2.3.2 Development and Purpose

The Long Stem Tube Stock Planting Technique was developed in response to the challenges of planting in flood-prone areas, as well as in regions with high erosion or heavy sediment deposition. It addresses the common issue of plants being uprooted or buried by sediment during flooding, a frequent problem in Australia's riverine and riparian zones. By burying part of the stem, the plants are more resilient to surface erosion and can survive even when substantial amounts of sediment are deposited around them.

2.3.3 Suitability for the Menangle Stage 8 Site

The Menangle Stage 8 site has struggled with regular flooding from the Nepean River, which has deposited sand and silt layers that bury conventional tube stock and direct seeding efforts. This has led to poor establishment rates and requires a more robust planting approach. The Long Stem Tube Stock Planting Technique is seen as a promising alternative because it would allow the planted vegetation to endure sediment deposition events, as the deeper planting provides added stability and the potential for re-rooting along the stem. By anchoring the plants deeper in the soil profile, this technique could enhance the success rate of

revegetation efforts at Menangle Stage 8 and reduce the need for replanting after floods.

Overall, the Long Stem Tube Stock Planting Technique aligns well with the unique challenges at Menangle Stage 8, offering a method that potentially improves plant establishment and resilience in areas affected by regular sediment deposition and flooding.

2.4 Planting Groups for Menangle Stage 8

Three (3) planting groups for the revegetation plan. Each group contains a mix of canopy trees and mid-story species, with an emphasis on compatibility and ecological function, including pioneer or coloniser species to encourage quick establishment.

2.4.1 Planting Plot Group 1:

Trees (Canopy Layer):

- *Angophora floribunda*
- *Casuarina glauca*
- *Eucalyptus baueriana*

Small Tree/Shrub (Mid-Story Layer):

- *Acacia floribunda* (Pioneer species, fixes nitrogen and improves soil quality)
- *Backhousia myrtifolia* (Adds biodiversity and mid-story coverage)

Rationale: This group includes species that are tolerant of wetter conditions and are commonly found in riparian areas, making them suitable for areas prone to flooding. *Casuarina glauca* and *Acacia floribunda* are pioneer species that will help establish the plot quickly, while *Angophora floribunda* and *Eucalyptus baueriana* provide canopy cover.

2.4.2 Planting Plot Group 2:

Trees (Canopy Layer):

- *Eucalyptus benthamii*
- *Casuarina cunninghamiana* subsp. *cunninghamiana*
- *Melia azedarach*

Small Tree/Shrub (Mid-Story Layer):

- *Acacia parramattensis* (Nitrogen-fixing pioneer species)
- *Breynia oblongifolia* (Provides mid-story habitat and diversity)

Rationale: *Eucalyptus benthamii* and *Casuarina cunninghamiana* are well-suited to flood-prone areas and are tolerant of a range of conditions. *Melia azedarach* adds variety to the canopy layer. The presence of *Acacia parramattensis* ensures that soil quality will improve over time, as it is a good coloniser and nitrogen-fixer.

2.4.3 Planting Plot Group 3:

Trees (Canopy Layer):

- *Eucalyptus tereticornis*
- *Eucalyptus elata*
- *Angophora subvelutina*

Small Tree/Shrub (Mid-Story Layer):

- *Acacia floribunda* (Included again for its pioneer characteristics and nitrogen-fixing benefits)
- *Backhousia myrtifolia* (Adds to mid-story structure)

Rationale: This group contains species that can handle a variety of soil conditions and are commonly found in woodland or open forest settings, making them resilient to environmental changes. *Eucalyptus tereticornis* and *Angophora subvelutina* are robust canopy trees, while *Acacia floribunda* helps with soil amelioration.

2.5 Mulching and Brush Cover

Each plot will be mulched to improve moisture retention and reduce weed competition. Where sufficient quantities of indigenous native brush is available, plots will also be mulched, as stipulated in the Consent document, to further protect plantings, facilitate seed distribution, and enhance site conditions.

3. Ongoing Management of Inter-Plot Areas

The areas between planting plots, known as inter-plot areas, will vary in size but will typically be approximately at least 20 meters wide to facilitate easy passage for rehabilitation maintenance vehicles and a slasher. These areas will be direct-seeded or hydromulched with a mixture of approved pasture-type exotic species and indigenous native seeds from the list of 40 species.

3.1 Native Species for Inclusion in the Seed Mix:

Grasses:

- *Themeda australis* (Kangaroo Grass)
- *Themeda triandra*
- *Microlaena stipoides* (Weeping Grass)
- *Austrostipa ramosissima*
- *Echinopogon ovatus*
- *Entolasia marginata*
- *Entolasia stricta*

Rushes:

- *Lomandra longifolia*
- *Lomandra multiflora*

Small Herbaceous Perennials:

- *Commelina cyanea* (Scurvy Weed)
- *Dichondra repens*
- *Veronica plebeia* (Trailing Speedwell)
- *Sigesbeckia orientalis subsp. orientalis*

The indigenous species selected for these inter-plot areas are known for their ability to establish effectively by direct seeding and withstand regular slashing. This approach provides several benefits:

- Ground Cover Establishment:** Establishing a robust ground cover will help to stabilise the soil, minimise erosion, and reduce the risk of weed invasion.
- Weed Competition:** By incorporating a mixture of pasture-type species, the Company can effectively manage competition from more aggressive weed species while still promoting the growth of native plants.

4. Practicality of Using Slashing for Weed Control

Slashing, or mowing, is a practical and cost-effective strategy for controlling weed growth across large, flood-prone revegetation areas. It offers several advantages:

- 4.1 Weed Suppression:** Regular slashing reduces the height of weeds and prevents them from setting seed, which limits the spread and persistence of unwanted species.
- 4.2 Encouraging Native Growth:** Many indigenous species selected for inter-plot seeding are adapted to periodic disturbance and can thrive under a slashing regime. This method can therefore support the gradual expansion of native vegetation.
- 4.3 Maintaining Access:** Slashing helps keep access routes open, facilitating ongoing maintenance and monitoring efforts.

5. Integrating Plots with Slashed Zones for a Connected Landscape

The Company's approach of combining intensively managed planting plots with slashed zones is designed to enhance the effectiveness of revegetation efforts by creating resilient native plant communities over time. Once the plots are well established, the aim is to connect them by allowing each plot to gradually expand into the surrounding slashed areas. This will be achieved through natural recruitment, supplementary planting, and adaptive management practices, including targeted weed control and soil amendments if necessary.

Over time, as the native plots expand and the slashed zones transition into more complex plant communities, the revegetation area will develop into a mosaic of diverse habitats. This strategy aims to overcome the flood-impacted limitations of previous efforts by focusing on localised intensive plantings that can withstand flooding events and contribute to the long-term success of the rehabilitation program.

6. Additional Species for Menangle Stage 8

The River-flat Eucalypt Forest (RFEF) Endangered Ecological Community (EEC) is a type of riparian woodland found along floodplains and riverbanks, particularly in the Nepean River region around Menangle, Camden, and Picton. Below is a list of additional species typically found in the RFEF community, categorised into the mid-storey layer, and ground layer (grasses, herbs, rushes, etc.). The Company proposes to start including species from the below list in revegetation efforts within Stage 8 to increase species diversity.

6.1 Mid-Storey Layer (Small Trees and Shrubs)

- *Bursaria spinosa* (Blackthorn)
- *Acacia dealbata* (Silver Wattle)
- *Acacia decurrens* (Green Wattle)
- *Dodonaea triquetra* (Common Hop Bush)
- *Leptospermum polygalifolium* (Yellow Tea-tree)
- *Melaleuca styphelioides* (Prickly-leaved Paperbark)
- *Melaleuca linariifolia* (Flax-leaved Paperbark)

6.2 Ground Layer (Grasses, Herbs, Rushes, etc.)

- *Cymbopogon refractus* (Barbed-wire Grass)
- *Juncus usitatus* (Common Rush)
- *Poa labillardieri* (Tussock Grass)
- *Poa sieberiana* (Snow Grass)

This additional species listed above are typically present in River-flat Eucalypt Forest and therefore considered suitable for inclusion for the revegetation at Menangle Stage 8.

7. Conclusion

The revised revegetation strategy for Stage 8 reflects the Company's commitment to adaptive management and ecological resilience in the face of challenging environmental conditions. By concentrating initial efforts on discrete planting plots with interspersed managed slashing zones, the Company aims to achieve sustainable restoration outcomes while addressing the practical difficulties posed by frequent flooding and weed reintroduction. This holistic approach balances intensive management with flexibility, promoting the establishment of a diverse and stable riverine ecosystem over time. The Company has communicated to the writer that it envisages that ultimately there is an opportunity for a several kilometres long connected riverine park, and where the

Company's riverfront lands could be dedicated to the local community in a natural, restored, self-sustaining park.

Long Stem Tube stock Planting Technique

Long-stem planting technique

Planting was carried out on 28th July 2002 during one of the Bushcare group's regular workdays. Equipment required on the day included hand tools for planting stock and construction plant protection, as well as a petrol driven, hand-held post hole auger.

Stock was installed using the following steps:

1. Pre-water the stock while still in the pot.
2. Marking out a suitable position for each plant on the ground.
3. Removing dense ground cover from the planting locations where required.
4. Digging a hole up to 80 cm deep and 20 cm wide using the petrol driven auger.
5. Pouring approximately 5 L of water into each hole and allowing the water to percolate into the soil.
6. Removing the pot and placing the plant in the hole to a depth sufficient to cover the stem of the plant, leaving not less than 90 mm of the stem and foliage above the ground.
7. Back-filling the hole and applying 5 L of water to each plant.
8. Constructing and installing a wire mesh plant protector secured to a frame of hardwood stakes (the guard protects plants from browsing wallabies).
9. Inscribe and attach an identification tag to each plant protector.

The most significant difference between the methods of installing the stock for this trial, compared with other riparian trials, is the exclusive use of a petrol driver auger rather than a water lancing jet as described by Bill. This was due to the fact that our site is not situated near a suitable water source.

Monitoring planted stock

Two distinct monitoring processes were used in this trial. These were, firstly, to monitor the visible health of each plant over a four-month period - and, secondly, to determine if a plant does or does not develop adventitious roots in the buried portion of the stem above the original root ball.

Above-ground inspection

Following installation, all planted stock was monitored in July and early November 2002. Each plant was assessed to determine, firstly, if it was alive and secondly, if it showed signs of stress or ill health.

Stress or ill health was determined by criteria visible to the assessor without removing the plant from the ground. Criteria used to describe the plant as being in ill health or under stress included:

1. Apparently healthy.
2. Reduced turgidity in leaves (wilting).
3. Loss of leaves with visible emerging buds, shoots or leaves to replace them.
4. Loss of leaves and no visible emerging buds, shoots or leaves to replace them.
5. Dead portions of woody stem.
6. Death of the entire plant.

Plants that were damaged by insects were noted and recorded. While pest damage may lead to the death of a plant, the intention of this study was to record the response of the plants to long-stemmed planting rather than their susceptibility to pest attack.

Below-ground inspection

In late October 2002, a sample of each plant species was removed from the soil for examination. It was at this point that data relating to the initiation of adventitious root growth was collected.

In addition to the final above-ground inspection described previously, each specimen was inspected and assessed for the:

1. Presence of adventitious root growth above the planted root ball.
2. Absence of adventitious root growth above the planted root ball.
3. Blemished covering of external tissue on the buried stem, with or without visible pest and disease.

The intention of this inspection was to determine if a plant species had developed adventitious roots, as well as looking for deterioration of the bark layer which may lead to health problems for the plant at a later point in time. Evidence of disease in the bark included:

- Missing or decaying bark,
- Pest attack resulting in loss of bark,
- Soft or watery appearance of bark compared with other portions of the stem, and/or
- Visible disfigurement due to a pest or disease.

Above and below-ground inspection of trial plants in Katandra Reserve					
Plant Name	Above ground inspections per species	Dead	Below ground inspections per species	Developed roots above original root ball?	
				Yes	No
<i>Acmena smithii</i>	8		5	4	
<i>Alphitonia excelsa</i>	3	2	2		2
<i>Ceratopetalum apetalum</i>	4	1	3	1	2
<i>Cryptocarya glaucescens</i>	4		3	2	1
<i>Ficus coronata</i>	5		2		2
<i>Ficus obliqua</i>	3		2	1	1
<i>Glochidion ferdinandi</i>	7		7	6	1
<i>Gmelina leichhardtii</i>	5		4	3	1
<i>Neolitsea dealbata</i>	1		1	1	
<i>Podocarpus elatus</i>	5		3		3
<i>Schizomeria ovata</i>	4		2	2	
<i>Sloanea australis</i>	1		1		1
<i>Synoum glandulosum</i>	2		2		2
<i>Tasmannia insipida</i>	6		3	1	2
<i>Trema aspera</i>	9	1	6	4	2
Total Plants	67	4	46	25	21

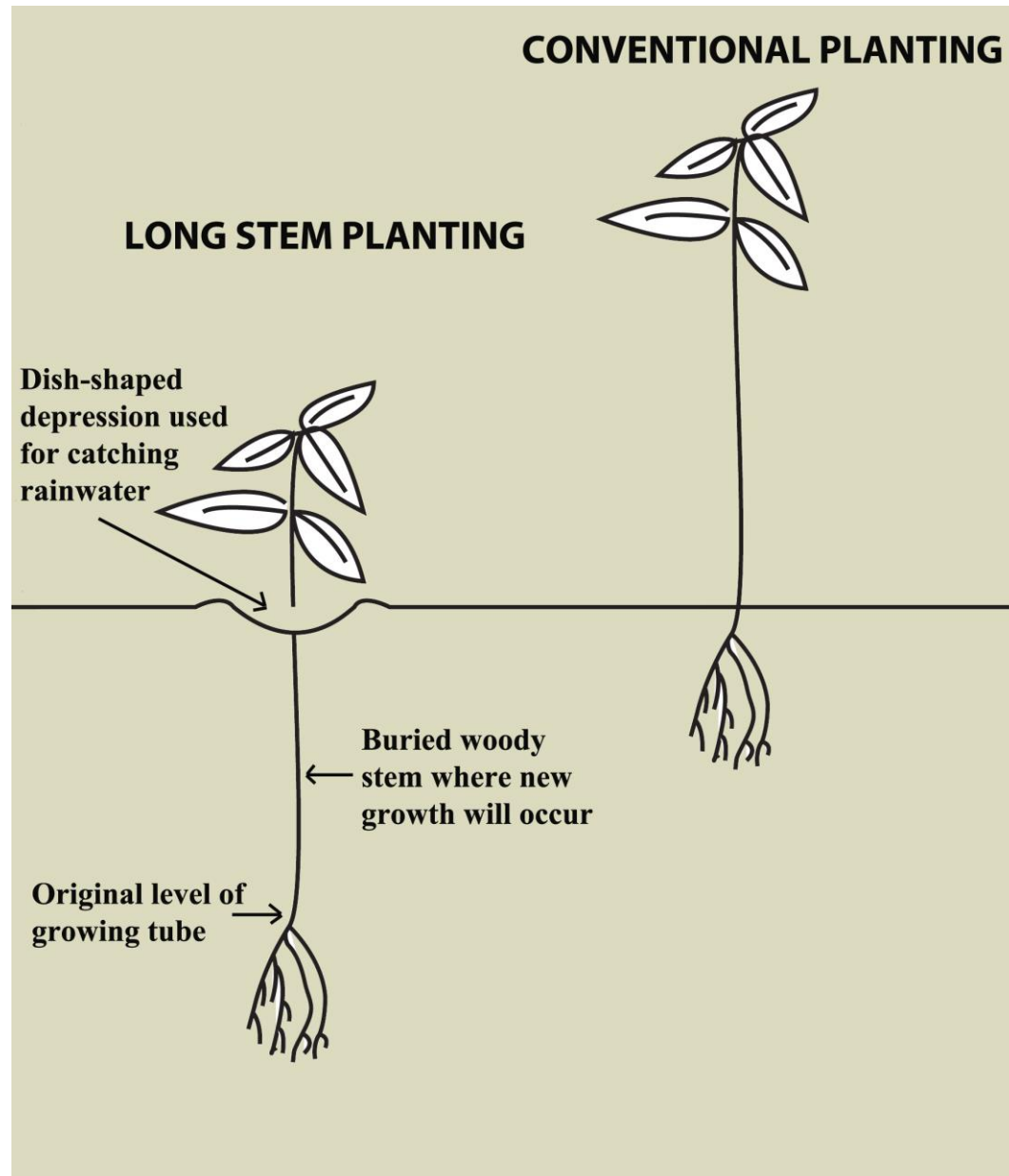
Within this trial, *Glochidion ferdinandi* appears to be the most suitable species for long-stem planting. With one of the largest cohort populations and below-ground inspections for every member of the cohort, these plants show the strongest and most reliable evidence of lateral, sub-surface adventitious root growth. In addition, every member of this population survived and increased in height in spite of the dry climatic conditions and persistent insect attack.

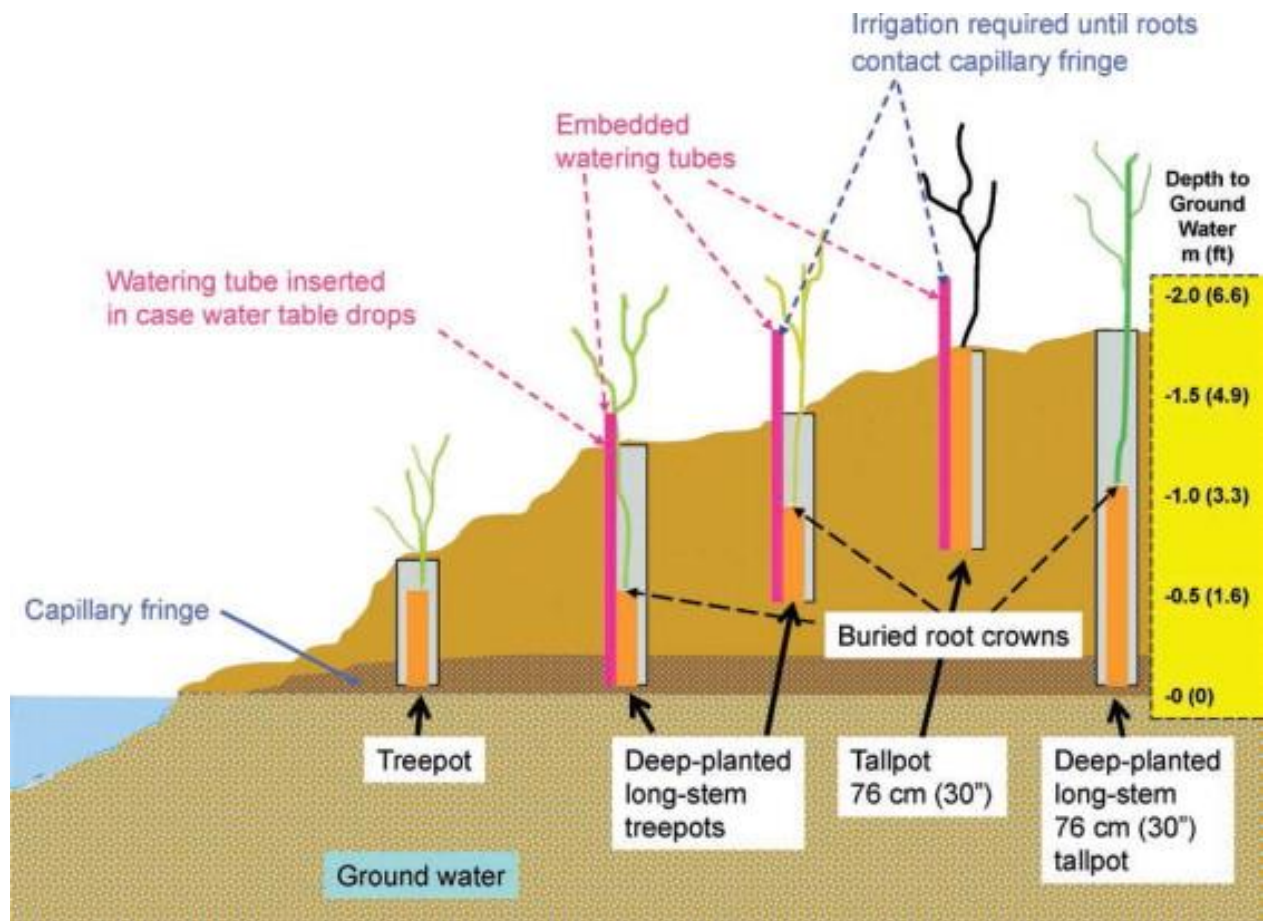
Species such as *Trema aspera*, *Acmena smithii* and *Schizomeria ovata* provide some encouraging data. There were limitations within this trial to these and other species however, which may have prevented these species proving to be as, or more suitable than *Glochidion ferdinandi*. These limitations are discussed below.

One observation that can be made following this trial using long-stem planting method with temperate rainforest plant species is that it did not result in the death of an entire cohort of samples. This indicates that it is a useful tool in the short-term establishment of these plants, and is worthy of additional testing in order to ascertain the medium to long-term impacts of this system on this range of rainforest plants.

Another observation made during this trial was the low impact of dense ground-covering plant growth (grasses, groundcovers, weeds, native *Rubus* sp.) on the growth of planted stock in the immediate vicinity. One advantage of the long-stem system would appear to be the fact that prior to the development of adventitious roots, the planted stock is not in direct competition with more shallow rooted plants for water or nutrients. In some instances, retaining and using the protection provided by tall dense weed growth may not only save a

land manager the cost of pre-planting weed control, but it may also prove to be a positive step towards the survival and vigour of planted stock in the short- to medium-term. These savings in weed control may offset any additional cost associated with hiring the specialised planting equipment.







S91i Log Book

Request ID: 394821

Applicant Name:	Michael Holz			Comments:	Conditions on the access licence are met for extracting water
Work Approval:	10WA104627				
Work Approval Holder:	Menangle sand & soil				
Extraction site ID:	56540				
Size of the meter:	100mm				
Date meter broken:	14/07/2020				
Meter reading as at date meter broken:	Unknown				
Meter reading as at date meter repaired:	Unknown				
Alternate read at the Break Down Date:					
Alternate Read when meter repaired/replaced:					
Calibration Factor for no alternate device or meter:	engine hours - 100,00 litres/fill			Additional information required:	
Purpose the water is used for:	industrial - dust suppression				
If irrigating, what is the size of area that is irrigated :					
Expiry Date of S91i:	30/09/2020				
Date	Truck fills / day	Run Minutes(5min/Fill)	10000L/Fill truck	ML Used - 1000000L	
<i>Eg. (enter fills per day)</i>		5	10000	1000000	<input type="checkbox"/> Yes <input type="checkbox"/> No
Saturday, 1 March 2025		0	0	0.000	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sunday, 2 March 2025		0	0	0.000	<input type="checkbox"/> Yes <input type="checkbox"/> No
Monday, 3 March 2025	7	35	70000	0.070	<input type="checkbox"/> Yes <input type="checkbox"/> No
Tuesday, 4 March 2025		0	0	0.000	<input type="checkbox"/> Yes <input type="checkbox"/> No
Wednesday, 5 March 2025		0	0	0.000	<input type="checkbox"/> Yes <input type="checkbox"/> No
Thursday, 6 March 2025	5	25	50000	0.050	<input type="checkbox"/> Yes <input type="checkbox"/> No
Friday, 7 March 2025	4	20	40000	0.040	<input type="checkbox"/> Yes <input type="checkbox"/> No
Saturday, 8 March 2025		0	0	0.000	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sunday, 9 March 2025		0	0	0.000	<input type="checkbox"/> Yes <input type="checkbox"/> No
Monday, 10 March 2025	5	25	50000	0.050	<input type="checkbox"/> Yes <input type="checkbox"/> No
Tuesday, 11 March 2025		0	0	0.000	<input type="checkbox"/> Yes <input type="checkbox"/> No
Wednesday, 12 March 2025		0	0	0.000	<input type="checkbox"/> Yes <input type="checkbox"/> No
Thursday, 13 March 2025	6	30	60000	0.060	<input type="checkbox"/> Yes <input type="checkbox"/> No
Friday, 14 March 2025	5	25	50000	0.050	<input type="checkbox"/> Yes <input type="checkbox"/> No
Saturday, 15 March 2025		0	0	0.000	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sunday, 16 March 2025		0	0	0.000	<input type="checkbox"/> Yes <input type="checkbox"/> No
Monday, 17 March 2025	6	30	60000	0.060	<input type="checkbox"/> Yes <input type="checkbox"/> No
Tuesday, 18 March 2025		0	0	0.000	<input type="checkbox"/> Yes <input type="checkbox"/> No
Wednesday, 19 March 2025		0	0	0.000	<input type="checkbox"/> Yes <input type="checkbox"/> No
Thursday, 20 March 2025		0	0	0.000	<input type="checkbox"/> Yes <input type="checkbox"/> No
Friday, 21 March 2025		0	0	0.000	<input type="checkbox"/> Yes <input type="checkbox"/> No
Saturday, 22 March 2025		0	0	0.000	<input type="checkbox"/> Yes <input type="checkbox"/> No
Sunday, 23 March 2025		0	0	0.000	<input type="checkbox"/> Yes <input type="checkbox"/> No
Monday, 24 March 2025		0	0	0.000	<input type="checkbox"/> Yes <input type="checkbox"/> No
Tuesday, 25 March 2025		0	0	0.000	<input type="checkbox"/> Yes <input type="checkbox"/> No
Wednesday, 26 March 2025		0	0	0.000	<input type="checkbox"/> Yes <input type="checkbox"/> No
Thursday, 27 March 2025		0	0	0.000	<input type="checkbox"/> Yes <input type="checkbox"/> No
Friday, 28 March 2025		0	0	0.000	<input type="checkbox"/> Yes <input type="checkbox"/> No

Saturday, 29 March 2025		0	0	0.000	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Sunday, 30 March 2025		0	0	0.000	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Monday, 31 March 2025		0	0	0.000	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Totals:	38	190	380000	0.380	<input type="checkbox"/>	<input type="checkbox"/>

Water Monitoring Requirements:

As per management plan testing of the Nepean River and site water is to be undertaken for a 12 month period

Location of Monitoring Points:

NR20 UPSTR
NR50 DOWNSTR
ACTIVE STAGE/8
PROC.PT STAGE/7

Summary of Results:

Pollutant	Unit of Measure	100 Percentile Concentration Limit	3/12/2024			
			NR20 UPSTR	NR50 DOWNSTR	ACTIVE STAGE/8	PROC.PT STAGE/7
pH	pH	No limits apply - sampling for monitoring purposes only	6.8	6.9	6.9	7
Conductivity	uS/cm		210	210	200	400
Turbidity	NTU		2.7	2.3	2.3	300
Ammonium Nitrogen	ug/L		22	19	17	100
Oxidized Nitrogen Nox-N	ug/L		160	150	150	2440
Total Organic Nitrogen	ug/L		750	600	880	1700
Total Nitrogen	ug/L		930	770	1050	4240
Phosphate Phosphorus	ug/L		10	5	10	30
Total Phosphorus	ug/L		40	25	20	110
Suspended solids	mg/L		120	28	34	50
Hardness as CaCO3	mg/L		51	54	57	225
oil and grease	mg/L		1	1	1	1
Aluminium (dissolved)	ug/L		50	55	50	45
Arsenic (dissolved)	ug/L		0.5	0.5	0.5	0.5
Boron (dissolved)	ug/L		45	30	25	70
Cadmium (dissolved)	ug/L		0.1	0.1	0.1	0.1
Chromium (dissolved)	ug/L		0.5	0.5	0.5	0.5
Copper (dissolved)	ug/L		0.5	0.5	0.5	0.5
Iron (dissolved)	ug/L		375	330	300	35
Manganese (dissolved)	ug/L		5	5	5	70
Lead (dissolved)	ug/L		0.5	0.5	0.5	0.5
Nickel (dissolved)	ug/L		0.5	0.5	0.5	0.5
Selenium (dissolved)	ug/L		0.5	0.5	0.5	0.5
Silver (dissolved)	ug/L		0.025	0.025	0.025	0.025